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Experime[illegible]Station

General Technical
Report
PNW-108

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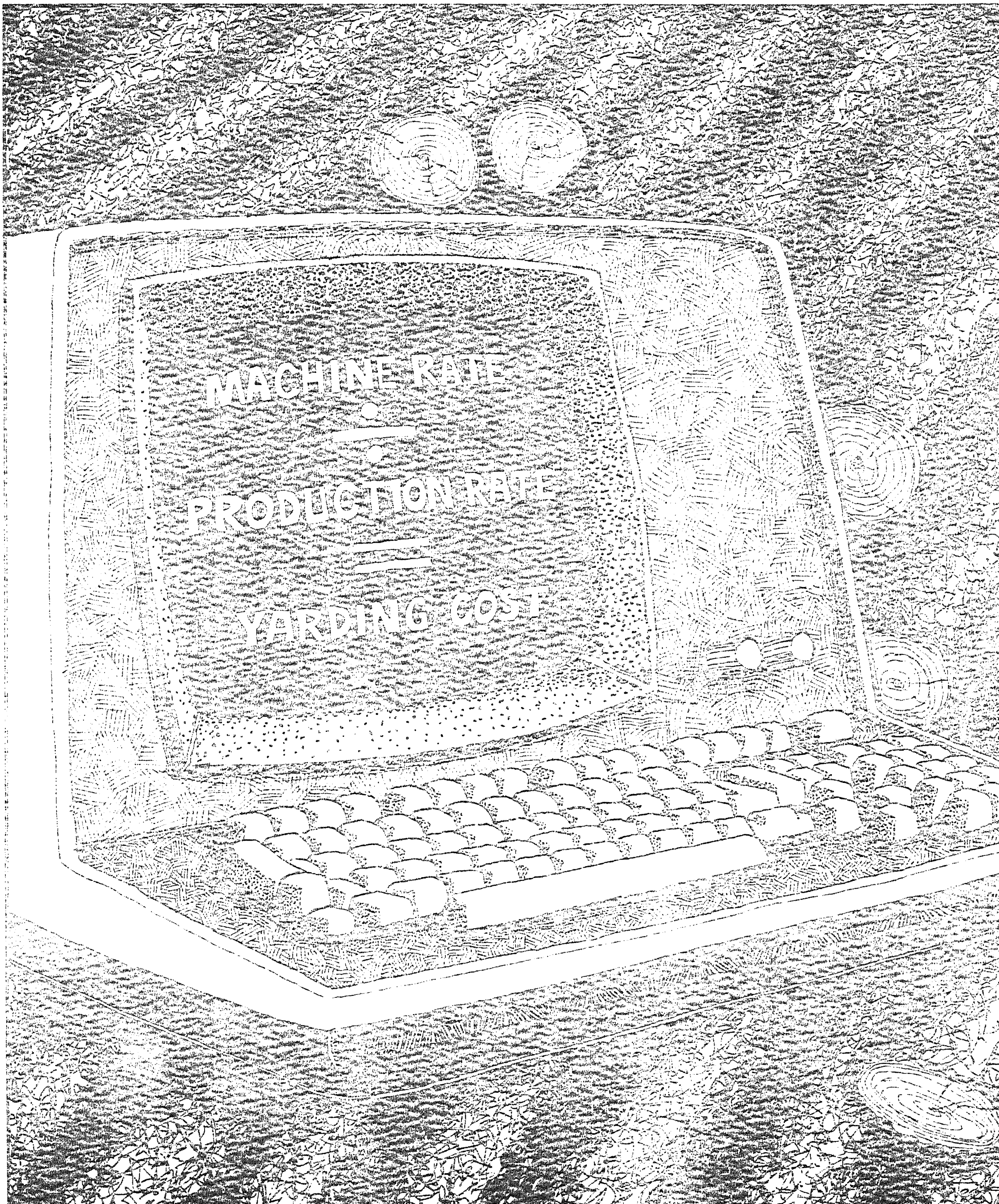
Computer Assisted Yarding Cost Analysis

Ronald W. Mifflin



Abstract

Programs for a programable calculator and a desk-top c
provided for quickly determining yarding cost and compa
economics of alternative yarding systems. The programs e
the importance of the relationship between production r
machine rate, which is the hourly cost of owning and op
yarding equipment. In addition to generating the data r
analyzing the cost of a yarding operation, the desk-top
plots the yarding cost versus production rate curve. Ex
simple step-by-step operating procedures are included.

Metric Equivalents

1 acre = 0.4047 hectare
1 gallon = 3.785 liters
1 foot = 0.3048 meter

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DESCRIPTION OF VARIABLES - 9845 PROGRAM

Introduction

Good logging planning is characterized by a systemat of alternatives and selection of the yarding system meets environmental and silviculture criteria for th Comprehensive cost analysis is needed in the plannin compare acceptable yarding systems.

This report presents programs for a programable calc desk-top computer for determining yarding cost and c alternative yarding systems. Both programs are based yarding cost structure given by Mifflin and Lysons (formulation is automated to enable the planner to qu alternatives.

Nature of the Problem

Selecting low priced equipment to reduce yarding cos the solution to economical yarding. Although equipme high, the cost of owning the equipment is generally by operating costs. Ownership and operating costs, w and expressed on an hourly basis, make up the machin and Lysons (1978) (see footnote 1) presented the brea cost components which make up machine rate (see figu duction rate is often a more critical factor in dete cost and is generally the most difficult aspect of y predict. Production rate is defined as the volume of to the landing per unit of time. The cost of road ch the yarder and rigging the lines) and the cost of mo equipment in and out also affect the yarding cost.

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[1] Mifflin, Ronald W., and Hilton H. Lysons. 1978. Sk cost estimating guide. USDA For. Serv. Res. Note PNW Pac. Northwest For. and Range Exp. Stn., Portland, O

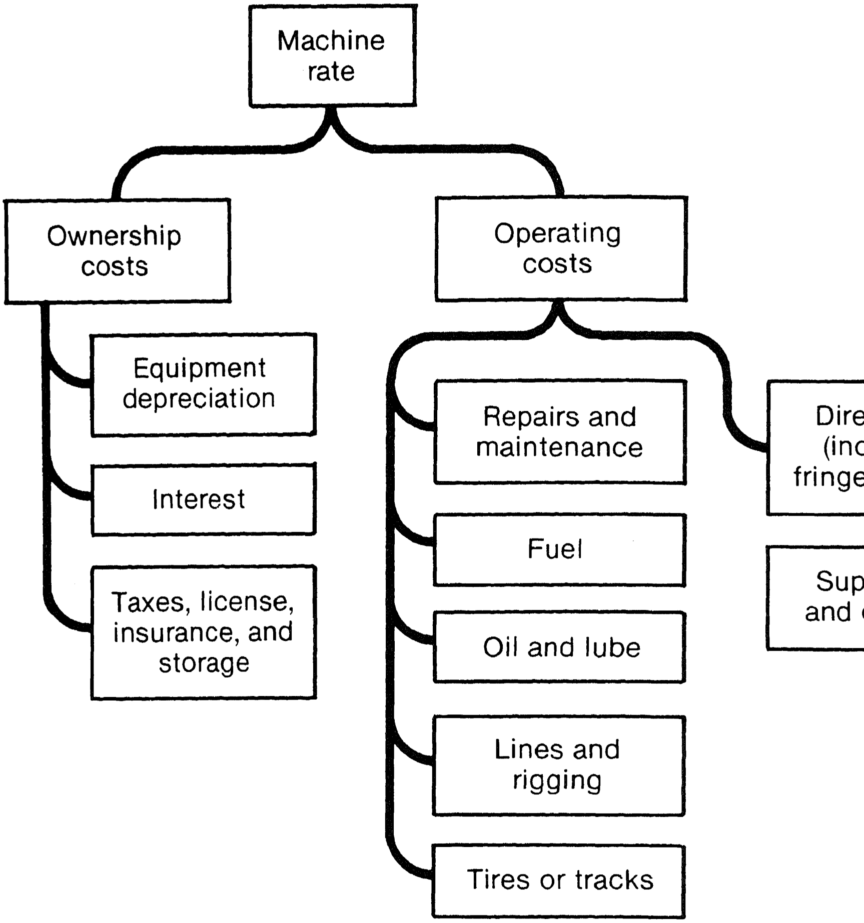


Figure 1.--Machine rate cost elements.

The yarding cost equation is expressed as

$$\text{YARDING COST (\$/UNIT VOLUME)} = \frac{\text{MACHINE RATE (\$/HOUR)}}{\text{PRODUCTION RATE (VOLUME}}$$

$$+ \frac{\text{MACHINE RATE (\$/HOUR)} \times \text{TOTAL ROAD CHANGE TIME (HOURS)}}{\text{TOTAL AREA (ACRES)} \times \text{YIELD (VOLUME/ACRE)}}$$

$$+ \frac{\text{MOVE IN AND MOVE OUT COST}}{\text{TOTAL AREA (ACRES)} \times \text{YIELD (VOLUME/ACRE)}} .$$

The importance of the yarding cost equation is shown in The curve is the plot of the equation for a given, const rate.

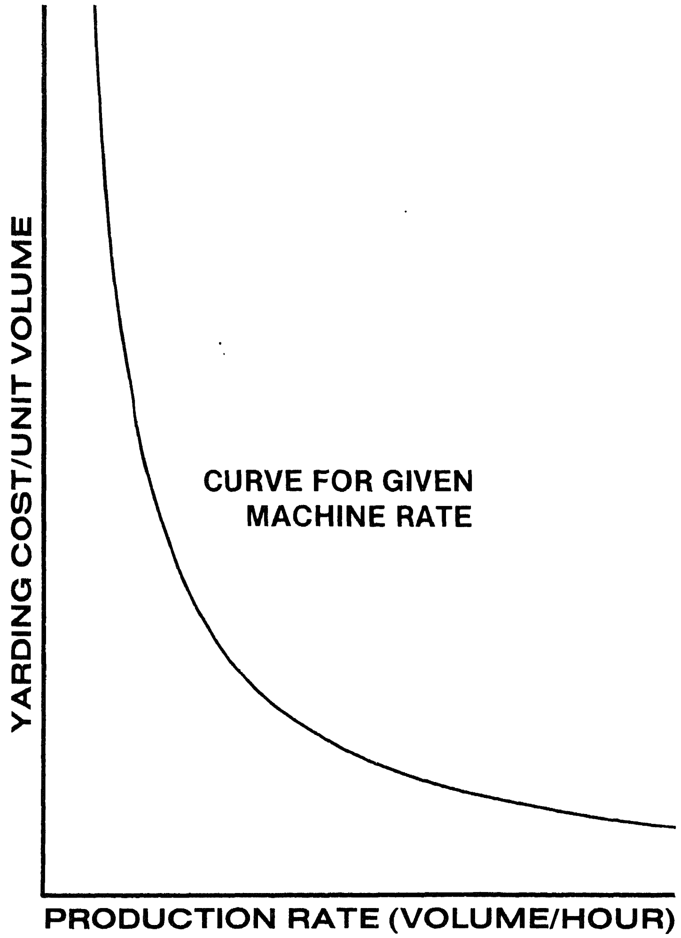


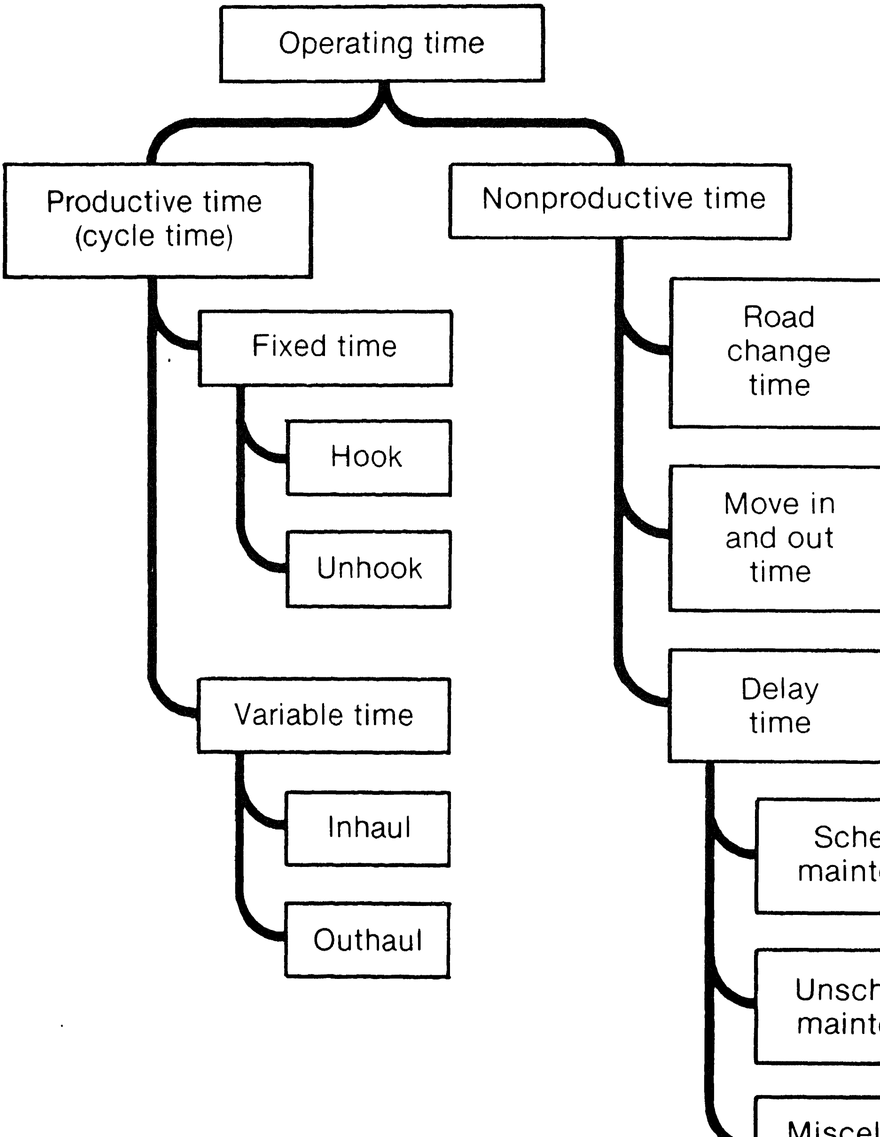
Figure 2.--Yarding cost versus production rate.

The most significant feature of the curve is the sensiti
yarding cost to changes in production rate. Production r
expressed algebraically as follows:

PRODUCTION RATE = AVERAGE LOG VOLUME X LOGS PER TURN X T

The average number of logs per turn tends to be constant
system, and is usually determined by the ability to gath
tered logs into a turn. The number of turns per hour is
dependent on machine design for a given yarding applicat
volume is therefore the most influential element in the
rate equation. Thus, in figure 2 the lower production ra
generally denotes small logs; and the higher rate, or ri
portion of the curve, denotes larger logs. With the inhe

The time spent operating in the woods is defined as oper
Figure 3 shows the components which make up operating ti
ductive time is the portion in which yarding takes place
the cycle time. The fixed time elements are normally con
a particular yarding system on a per setting basis. Hook
unhooking chokers are independent of yarding distance. T
and outhaul of chokers are directly related to yarding d
and are therefore variable times. Nonproductive time inc
change time (rigging and moving to a new yarding road),
and move out time, and delay time. No yarding takes plac
these times. The following example illustrates the cost



of small-log harvesting and the usefulness of makinc
cost analysis when comparing alternative yarding sys

Two small-log yarding systems for use in thinning op
compared on the basis of cost. Both systems employ s
operated by a crew of three. Cost and production dat
for both yarders and detailed in table 1. The equipm
for System 1 is $70,000. System 2 equipment is value
The machine rates are $65.59 for System 1 and $79.13
Thus, a 100-percent increase in equipment cost resul
rate increase of only 21 percent.

It is assumed that added design features of the Syst
lower its yarding cycle time and reduce delays. This
ductivity by increasing turns per hour. The producti
System 2 is 3.5 cunits[2]/hour compared to 2.1 cunits/
with System 1. Log volume is assumed to be 10 cubic
(0.1 cunit), and turn size averages 3.5 logs per tur
systems. The difference in production rate is due to
turns per hour; 10 for System 2 and 6 for System 1.

The gain in production rate for System 2 is achieved
of doubling the cost of equipment. On a cost per uni
however, the cost saving is significant. The yarding
System 2 is $24.54/cunit, a 26-percent decrease from
cunit cost for System 1. The plot of the yarding cos
figure 4 illustrates this situation.

---

[2] A cunit is a unit of volume measuring 100 cubic fee

Item	Unit	System 1	Syste
Equipment cost	Dollars	70,000	140,
Residual	Percent equipment cost	20	
Depreciation period	Years	7	
Repairs and maintenance	Percent equipment depreciation	50	
Annual interest rate	Percent	12	
Tax, license, insurance, and storage	Percent	9	
Operating season	Days worked/year	200	
Operating time per day	Hours	8	
Fuel consumption	Gallons/hour	2	
Fuel cost	Dollars/gallon	.80	
Oil and lube	Percent fuel consumption	5	
Oil and lube cost	Dollars/gallon	1.50	1
Line cost	Dollars	3,600	3,
Line life	Hours	1600	1
Rigging cost	Dollars	1,000	1,
Rigging life	Hours	800	
Tire or track replacement cost	Dollars	0	
Total crew wage	Dollars/hour	30	
Fringe benefits	Percent total crew wage	30	
Travel time per day	Hours	0	
Supervision and overhead	Percent direct labor	20	
Cutting unit area	Acres	35	
Yield per acre	Cunits	40	
Average volume per piece as bucked	Cunits	0.1	
Average number of pieces per turn		3.5	
Average number of turns per hour		6	
Number of yarding roads in unit		10	
Time per road change	Hours	1	
Move in and move out cost	Dollars	2,000	2,
Ownership cost	Dollars/hour	11.04	22
Operating cost	Dollars/hour	54.55	[1]57
Machine rate	Dollars/hour	65.59	79
Production rate	Cunit/hour	2.1	3
Road change cost	Dollars/cunit	0.42	0.
Move in and move out cost	Dollars/cunit	1.43	1.
Yarding cost	Dollars/cunit	33.08	24.

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[1] The operating costs for the two systems would be equal except that repair and maintenance cost (a part of operating cost) increases proportionately w an increase in equipment cost.

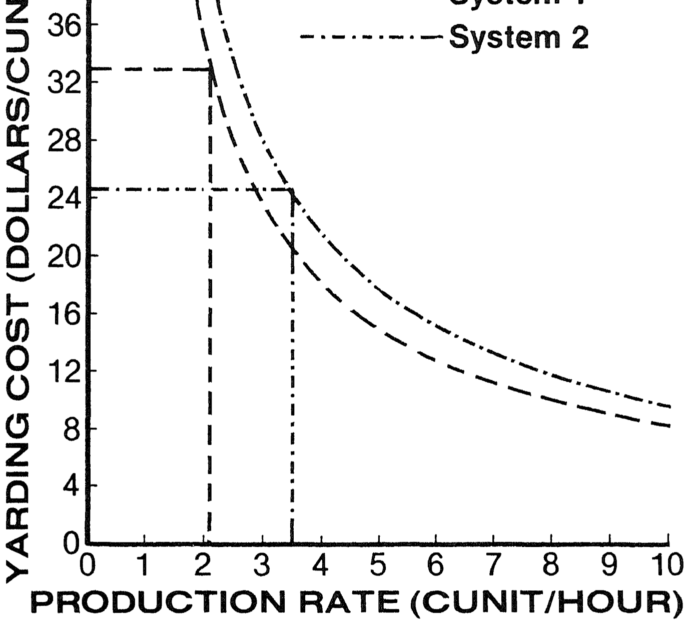

Figure 4.--Yarding cost versus production rate curves for System 1 and System 2.

plication

The programable calculator and desk-top computer programs re inputs relating to ownership cost, operating cost, cruise da and production rate estimates. These values are entered in a based on the worksheets developed by Mifflin and Lysons (197 footnote 1). The programs compute yarding cost and productio using data initially entered as base values. These can be ch and the results of these new values compared to the base val

The desk-top computer program supplies printed output not av on the calculator. Input values and results are documented. desk-top program also plots curves to help the planner visua the sensitivity of the relationship between yarding cost and production rate (figure 4).

The desk-top program, although it may appear complicated or lengthy, is a straight-forward, step-by-step method for dete mining machine rate and yarding cost. Once that is done, a n of optional steps may be taken to produce a more detailed ya system cost analysis. The basic functions of the program are in figure 5.

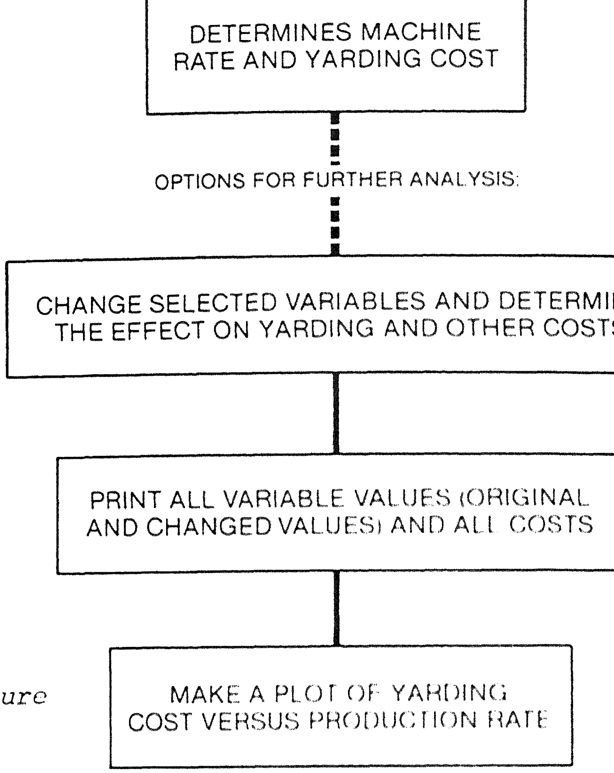
DETERMINES MACHINE RATE AND YARDING COST
OPTIONS FOR FURTHER ANALYSIS:
CHANGE SELECTED VARIABLES AND DETERMI
THE EFFECT ON YARDING AND OTHER COST
PRINT ALL VARIABLE VALUES (ORIGINAL AND CHANGED VALUES) AND ALL COSTS
MAKE A PLOT OF YARDING COST VERSUS PRODUCTION RATE

Figure 5.--Basic structure of desk-top computer program.

er's Guide

Operating instructions and program listings are given for a programable calculator and a desk-top computer system. They w developed on, but not limited for use on, a Hewlett-Packard 9 or 67 calculator and a 9845A or 9845B desk-top computer using ASCII BASIC language. The desk-top system requires a minimum internal memory capacity of 50,000 bytes. Certain output may generated on a peripheral plotting device if available, as we on the CRT screen or internal printer. The program was develo to use the Hewlett-Packard 9872A plotter.

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[3] Mention of trade names does not constitute endorsement by th USDA Forest Service over other brands that can do equivalent functions.

the use of these programs will be provided.

eration of ogramable lculator ogram

The inputs to this program are similar to the worksheets de by Mifflin and Lysons (1978) (see footnote 1) for determinin machine rate, production rate, and yarding cost. The progra provides a faster means of computing the same values that c derived by hand using the worksheets.

General Information

1. This program is comprised of three sections. The first ownership cost and is entered through key A. The second com operating cost and is entered through key C. The third calc production rates and yarding costs and is entered through k key E.

2. Only one piece of equipment at a time may be entered, u the desk-top computer program which allows up to nine piece analyzed simultaneously.

3. Values for all variables must be entered. If variables applicable or are zero, they must be entered as zero.

4. If a mistake is made while entering values, either cont through the section and then start the section over, or pre "GTO" then ".001," and start the section over.

5. If you desire to change one or more variables in a sect the variables for the entire section must be re-entered. Al Section I is redone, Section II must also be redone. Sectio Section III, however, can be redone alone.

6. Certain machine or production values may be accessed du after program completion. Table 2 shows what values are sto where they reside. Values are displayed by pressing "RCL," recall key, then the appropriate storage register key (A, B E or 0-9).

Table 2--Storage register values

Storage register	Value displayed after completion of Section:		
	I	II	III
A	residual value	residual value	residual value
B	equipment depreciation	equipment depreciation	equipment depreciation
C	average annual investment	average annual investment	average annual investment
D	hours worked per day	hours worked per day	hours worked per day
E	hours worked per year	hours worked per year	hours worked per year
0	taxes, license, insurance, and storage cost	taxes, license, insurance, and storage cost	taxes, license, insurance and storage cost
1	ownership cost (dollars/hour)	ownership cost (dollars/hour)	ownership cost (dollars/hour)
2		operating cost (dollars/hour)	operating cost (dollars/hour)
3		machine rate (dollars/hour)	machine rate (dollars/hour)
4		supervision and overhead (percent)	gross production rate (volume/hour)
5		fuel consumed (gallons/hour)	gross road change cost (dollars/unit volume)
6	depreciable value	depreciable value	gross move in and move ou cost (dollars/unit volu
7	depreciation period	depreciation period	gross yarding cost (dollars/unit volume)
8			(100-percent defect)/100
9			net yarding cost (dollars/unit volume)

Operating Procedures

1. Set calculator to "run" and "manual" modes.

2. Insert sides 1 and 2 of program card. Display will read 0.00

A sample response is shown in parentheses following each step. Sample output is shown following all input steps. The relationsh between program input and use of the worksheets can be seen by comparing the inputs (shown in parentheses) with the bold-faced values entered on the worksheets, pages 14 through 17.

Section I. Ownership Cost

1. Key in: Equipment cost, press ENTER↑ (140000
   Key in: Residual (percent of equipment cost), press ENTER↑ (2
   Key in: Depreciation period (years), press A (
   Display: equipment depreciation (dollars/year) 16000.0

(percent of average annual investment), press ENTER↑
Key in: Operating season (days worked/year), press ENTER↑
Key in: Operating time per day (hours), press A
Display and print: ownership cost, dollars/hour

Section II. Operating Cost

1. Key in: Repairs and maintenance cost (percent of equipment depreciation), press ENTER↑
Key in: Fuel consumption (gallons/hour), press ENTER↑
Key in: Fuel cost (dollar/gallon), press C
Display: repairs and maintenance cost, dollars/hour

2. Key in: Oil and lube (percent of fuel consumption), press ENTER↑
Key in: Oil and lube cost (dollars/gallon), press ENTER↑
Key in: Line cost, press ENTER↑
Key in: Line life (hours), press C
Display: oil and lube cost, dollars/hour

3. Key in: Rigging cost, press ENTER↑
Key in: Rigging life (hours), press ENTER↑
Key in: Tire or track replacement cost, press ENTER↑
Key in: Tire or track life (hours), press C
Display: rigging cost, dollars/hour

4. Key in: Total crew wage, press ENTER↑
Key in: Percent fringe benefits, press ENTER↑
Key in: Travel time (hours/day), press ENTER↑
Key in: Supervision and overhead (percent of direct labor cost), press C
Print: operating cost, dollars/hour
Display and print: machine rate, dollars/hour

Unknown production rate:

1. Key in: Average volume per piece as bucked, press ENTER↑
   Key in: Average number of pieces per turn, press ENTER↑
   Key in: Average number of turns per hour, press D
   Display: gross production rate,
   unit volume/hour

2. Key in: Percent defect in pieces as yarded,
   press ENTER↑
   Key in: Number of yarding roads in cutting unit,
   press ENTER↑
   Key in: Time per road change (hours), press ENTER↑
   Key in: Move in and move out cost, press D
   Display: (100-percent defect)/100

3. Key in: Area of unit, press ENTER↑
   Key in: Yield (unit volume/unit area), press E
   Print: remainder of output
   (see Sample Output, p. [illegible])

Known production rate:

1. Key in: Production rate (unit volume/hour), press E
   Display: gross production rate,
   unit volume/hour
2. Key in: Percent defect in pieces as yarded, press ENTER↑
   Key in: Number of settings in cutting unit, press ENTER↑
   Key in: Time per setting change (hours), press ENTER↑
   Key in: Move in and move out cost, press E
   Display: (100-percent defect)/100

3. Key in: Area of unit, press ENTER↑
   Key in: Yield (unit volume/unit area), press E
   Print: remainder of output
   (see Sample Output, p. [illegible]

During execution, costs and production rates are printed o
tape. At completion of the program, the tape output will a
shown below:

```
22.08  ***   Ownership cost, dollars/hour
57.05  ***   Operating cost, dollars/hour

79.13  ***   Machine rate, dollars/hour

 3.50  ***   Gross production rate, unit volume/hour
 3.15  ***   Net production rate, unit volume/hour

 0.51  ***   Gross road change cost, dollars/unit vol
 1.43  ***   Gross move in and out cost, dollars/unit

 0.57  ***   Net road change cost, dollars/unit volum
 1.59  ***   Net move in and out cost, dollars/unit v

24.54  ***   Gross yarding cost, dollars/unit volume
27.27  ***   Net yarding cost, dollars/unit volume
```

Equipment Ownership Cost

Delivered equipment cost $ 140000

Less line and rigging cost - $ —

Less tire or track replacement cost - $ —

Less residual (salvage) value - $ 2800 (= 20%)

Depreciable value $ 112000

Equipment depreciation: $\frac{\text{(Depreciable value)}}{\text{(Depreciation period)}} = \frac{(\$\ 112000\ )}{(\ 7\ \text{yr})}$ $ 16000 /yr

Average annual investment: $\frac{\text{(Depreciable value)} \times \text{(Depreciation period + 1)}}{2 \times \text{(Depreciation period)}} + \text{(Residual value)}$

$= \frac{(\$\ 112000\ ) \times (\ 8\ )}{2 \times (\ 7\ )} + (\$\ 28000\ ) = \$\ 92000\ /\text{yr}$

Interest expense: (Annual interest rate) x (Average annual investment) = (12 %) x ($ 92000/yr) + $ 11040 /yr

Taxes, license, insurance & storage: ___% of Average annual investment = (9 %) x ($ 92000 /yr) + $ 8280 /yr

Annual ownership cost: $ 35320 /yr

Annual utilization: (200 days worked/yr) x (8 hours worked/day) = 1600 hr/yr

Ownership cost: $\frac{\text{(Annual ownership cost)}}{\text{(Annual utilization)}} = \frac{(\$\ 35320\ /\text{yr})}{(\ 1600\ \text{hr/yr})}$ $ 22.08 /yr

Equipment Operating Cost

Repairs and maintenance: $\frac{\text{\% of Equipment depreciation}}{\text{Annual utilization}} = \frac{(50\%) \times (\$\,16000\ /\text{yr})}{(1600\ \text{hr/yr})}$ $\$\ 5.00$ /hr

Fuel: (2 gal/hr) x ($ .80 /gal) + $ 1.60 /hr

Oil & lubricants: (____% of fuel consumption) x (unit cost) = (5 %) x (____gal/hr) x ($ 1.50 /gal) + $ 0.15 /hr

Lines: $\frac{\text{(Cost)}}{\text{(Estimated life)}} = \frac{(\$\ 3600\ )}{(\ 1600\ \text{hr})}$ + $ 2.25 /hr

Rigging: $\frac{\text{(Cost)}}{\text{(Estimated life)}} = \frac{(\$\ 1000\ )}{(\ 800\ \text{hr})}$ + $ 1.25 /hr

Tires or tracks: $\frac{\text{(Replacement cost)}}{\text{(Estimated life)}} = \frac{(\$\ 0\ )}{(\ 0\ \text{hr})}$ + $ 0 /hr

Crew position: ________ ________ ________ ________ ________ ________

Base wage: $ 11 /hr + $ 10 /hr + $ 9 /hr + $_____/hr + $_____/hr + $_____/hr

Total crew wage: $ 30 /hr

Direct labor cost: $\text{(Total crew wage)} \times \left[\frac{(100 + \text{\% fringe benefits})}{100} + \frac{\text{(travel time/day)}}{\text{(operating time/day)}}\right]$

$= (\$\ 30\ /\text{hr}) \times \left[\frac{(100 + 30\%)}{100} + \frac{(\ 0\ \text{hr/day})}{(\ 8\ \text{hr/day})}\right]$ + $ 39.00 /hr

Supervision and overhead: ____% of direct labor cost = (20 %) x ($ 39.00 /hr) + $ 7.80 /hr

Operating cost: $ 57.05 /hr

Cruise Data

Area of unit: A = 35 acres

Yield per acre : V = 40 cunits/ acre

Gross unit volume: V_T = (V) x (A) = (40 cunits/ acre) x (35 acres) = 1400 cunits

Average volume per log as cruised = —

Average volume per piece as bucked: v = .1 cunit

Percent defect in stand as cruised = – %

Percent defect in pieces as yarded: D = 10 %

Engineering Data

Number of settings in cutting unit: N = 10

Average yarding distance = —

Estimates

Average number of pieces per turn: n = 3.5

Average volume per turn: v_t = (v) x (n) = (.1 cunit) x (3.5) = .35 cunits

Average turns per hour: C = 10

Delay as a percentage of turns per hour: d = ___ %

Adjusted turns per hour: $c = (C) \times \frac{(100 - d)}{100} = (\_\_\_) \times \frac{(100 - \_\_\_ \%)}{100}$ = 10

Time per setting change: t_s = 1 hours

Total setting change time: $T_s = (t_s) \times (N - 1)$ = (___ hr) x (9) = 9 hours

Calculations

Number of turns: $\frac{(\text{Gross volume, } V_T)}{(\text{Volume per turn, } v_t)} = \frac{(1400 \text{ cunits})}{(3.5 \text{ cunits})} = \underline{4000}$

Operating time: $\frac{(\text{Number of turns})}{(\text{Adjusted turns per hour, } c)}$ + Total setting change time

$= \frac{(4000)}{(10)} + \underline{9} \text{ hr} = \underline{409} \text{ hours}$

Yarding cost: (Machine rate) x (Operating time) = (\$ 79.13 /hr) x (409 hr) = \$ 32364.17

Add move-in and move-out cost, M: + \$ 2000.00

Total yarding cost: \$ 34364.17

Yarding cost per gross unit volume: $\frac{(\text{Ysrding cost})}{(\text{Gross volume, } V_T)} = \frac{(\$34364.17)}{(1400)} =$ \$ **24.54 /cunit**

Net volume: $(\text{Gross volume, } V_T) \times \frac{(100 - \% \text{ defect, D})}{100} = (1400) \times \frac{(100 - 10\,\%)}{100} =$ 1260 cunits

Yarding cost per net unit volume: $\frac{(\text{Yarding cost})}{(\text{Net volume})} = \frac{(\$34364.17)}{(1260)} =$ \$ **27.27 /cunit**

For total logging system cost, add:

Roading cost per net unit volume = + \$______/______

Felling cost per net unit volume = + \$______/______

Loading cost per net unit volume = + \$______/______

Hauling cost per net unit volume = + \$______/______

More than one piece of equipment may be analyzed as part of a single yarding operation. For example, a yarder, carriage and rigging hardware can be included in the yarding cost analysis re-running the program. The steps below should be followed for second and subsequent pieces of equipment:

1. In Section I, enter the equipment cost, residual and depreciation period.
2. In Section I, re-enter the original values of annual intere rate, taxes, license, insurance, and storage, operating season, and operating time per day.
3. In Section II, enter repairs and maintenance cost, then ent for the remaining variables.
4. In Section III, re-enter the original values for all variat except move-in and move-out costs for which the entry is 0.
5. The tape output values corresponding to ownership cost, operating cost, machine rate, road change cost and yarding cost for each piece of equipment should be added together for the to cost.

ation of -Top outer ram

With the program stored on a tape cartridge, it is executed as follows:

Initial Data Entry

1. Enter GET "YCOST" and execute.
2. Press RUN when program is loaded.

From this point on, visual prompts on the CRT screen will guide further input. A sample keyboard response is shown in parenthes following the underscored prompt message.

The CONT key must be pressed after each entry.

3. Want output on the screen? (YES or NO) - If (NO), output w be on the printer. (NO)
   Y or N may always be entered in place of YES or NO.

4. Do you want a heading for all output? (YES or NO) (YE
   If (NO) skip step 5.

(SAMPLE OUTPUT)

The characters entered here will be printed as a sing line at the top of each section of output; i.e., the generated by the initial run and keys 1, 2, 3, 11, 12 14, and 15.

6. Number of pieces of equipment to depreciate = ? (2)

   Up to nine pieces of equipment associated with an ope may be entered. One may represent a yarder, another t carriage, etc. If six or more are entered, the follow message will be displayed for 7 seconds:

   "Screen output may be incomplete for VARIABLE CHANG PRINT ANALYSIS routines!"

   Some portion of the results may be missing on the scr due to a lack of buffer space for screen output. Resu cost values will be correct, however, and output on t printer will be complete.

   For various entries, such as above, a non-zero value required. If zero is entered, a message will indicate and the original prompt will return to allow the valu be re-entered.

7. For piece #1: Equipment identifier (30 characters maxi = ? (YARDER)

8. For piece #1: Cost of YARDER (dollars) = ? (125000

9. For piece #1: Residual value (percent of equipment cos (20)

10. For piece #1: Depreciation period (years) = ? (7)

11. For piece #1: Repairs and maintenance (percent of equi depreciation, $14286 per year) = ? (50)

    The value shown is the amount of equipment depreciati

12. For piece #2: Equipment identifier (30 characters maxi = ? (CARRIAGE)

13. For piece #2: Cost of CARRIAGE (dollars) = ? (3000

14. For piece #2: Residual value (percent of equipment cos (10)

16. For piece #2: Repairs and maintenance (pct of equip. depr
$540 per year) = ? (20)

17. Annual interest rate (percent) = ? (12)

18. Taxes, license, insurance & storage (pct of avg. ann. invest., $84063) = ? (9)
The value shown is the amount of the average annual investment.

19. Operating season (days worked/year) = ? (200)

20. Operating time per day (hours) = ? (8)

21. Fuel consumption (gallons/hour) = ? (3)

22. Fuel cost (dollars/gallon) = ? (.80)

23. Oil and lube consumption (percent of fuel consumption) = ?
(5)

24. Oil and lube cost (dollars/gallon) = ? (1.50)

25. Line cost (dollars) = ? (3600)
If line cost = 0, skip step 26.

26. Estimated line life (hours) = ? (1600)

27. Rigging cost (dollars) = ? (1000)
If rigging cost = 0, skip step 28.

28. Estimated rigging life (hours) = ? (800)

29. Tire or track replacement cost (dollars) = ? (0)
If tire or track replacement cost = 0, skip step 30.

30. Estimated tire or track life (hours) = ?

31. Total crew wage (base wage for all crew members, dollars/hour) = ? (30)

32. Fringe benefits (percent of total crew wage) = ? (30)

33. Travel time per day (hours) = ? (.5)

hour) = ?   (20)

Direct labor is expressed algebraically as

$$(\text{total crew wage}) \times \frac{100 + \%\ \text{fringe benefits}}{100} + \frac{\text{travel time/}}{\text{operating tim}}$$

35. Volume units = ? (5 characters maximum)   (CUNIT)

36. Is known production rate to be entered? (YES or NO)

Sample output will be shown for both cases. If (NO), continue at step 45.

Known Production Rate - EXAMPLE 1

37. Percent defect in pieces as yarded = ?   (0)

38. Number of yarding roads in unit = ?   (11)

Total road change time is calculated by multiplying t time per road change by the number of yarding roads i cutting unit less one. Set-up for the first or only y road is mandatory and considered part of move in.

39. Time per road change (hours) = ?   (1)

40. Production rate (cunit/hour) = ?   (5)

41. Move in and move out cost (dollars) = ?   (2000)

42. Cutting unit area (acres) = ?   (35)

43. Yield per acre (cunit) = ?   (40)

Steps 42 and 43 are required to express the road char cost and move in and move out cost in dollars/unit vo If total road change time and move in and move out co zero, area and yield are not needed.

44. Enter identifier (25 characters maximum)   (EXAMPLE 1

If nothing is entered (i.e., only the CONT key is pre no identifier will be used.

Note: Skip remaining steps (45-51).

Calculate Production Rate - EXAMPLE 2

45. Average volume per piece as bucked (cunit) = ?   (.1

46. Percent defect in pieces as yarded = ?   (6)

No road change time is required for one setting.

48. Average number of pieces per turn = ? (3.5)

49. Average number of turns per hour = ? (12.5)
The value of turns per hour should account for delays.

50. Move in and move out cost (dollars) = ? (0)

51. Enter identifier (25 characters maximum) (EXAMPLE 2)
If nothing is entered (i.e., only the CONT key is press
no identifier will be used.

The initial data entry is complete. The results for the two sa
outputs are shown in figures 6 and 7. Yarding cost is the mach
rate divided by production rate plus road change cost plus mov
and move out cost. When percent defect in pieces yarded equals
zero, no distinction is made between gross and net values. In
figure 7, however, the difference between gross and net values
due to the percent defect in pieces yarded.

Further action must be initiated through the special function
keys. The overlay card, figure 8, defines the keys.

```
SAMPLE OUTPUT


YARDING COST PROGRAM


Values are for EXAMPLE 1


OWNERSHIP COST = $   20.30 HOUR
OPERATING COST = $   59.71 HOUR
                 -------------
MACHINE RATE =   $   80.01 HOUR

PRODUCTION RATE =    5.00 CUNIT HOUR

ROAD CHANGE COST = $    .57/CUNIT
MOVE IN AND OUT COST =  $  1.43 CUNIT


YARDING COST = $  18.00/CUNIT
```

Figure 6.--Printed sample output for known production rate.

```
YARDING COST PROGRAM

Values are for EXAMPLE 2

OWNERSHIP COST = $  20.30/HOUR
OPERATING COST = $  59.71/HOUR
                 -------------
MACHINE RATE =   $  80.01/HOUR

GROSS PRODUCTION RATE =   6.13 CUNIT/HOUR

NET PRODUCTION RATE =     5.76 CUNIT/HOUR


GROSS YARDING COST = $  13.06/CUNIT

NET YARDING COST =   $  13.90/CUNIT
```

Figure 7.--Printed sample output for calculated production rate.

SPECIAL FUNCTIONS

S					Base values replaced by new values			
	Variable changes	Print analysis	Part 1	Part 2	New values replaced by base values	Output on screen	Output on printer	Rewind T15
S	Hard copy of plot		Plot only					
	Plot on screen	Plot on plotter	Axes and plot	Change ownership cost	Change operating cost	Change machine rate	Change gross volume/hour	Change net volume/hou

ure 8.--Special function key overlay.

All future output will be displayed on the CRT screen.

Key 6 - Output on Printer

All future output will be printed on the internal printer.

Key 1 - Print Analysis

The values of all variables will be displayed along with the resultant costs and production rates. Each variable is numbere and the "base values" correspond to the initial data entered previously. The "new values" and "percent change" are explaine under Key 0 - Variable Changes. Until a variable is changed wi Key 0, the "new values" equal the "base values" and "percent change" is zero. Figures 9 and 10 present the base values ente previously as EXAMPLE 1 and EXAMPLE 2.

For output on the screen, the variables up to number 22 will b displayed. Key 3 must be pressed to display the remainder of t analysis.

Key 2 - Part 1

For output on the screen, this key displays the variables up t number 22 exactly as Key 1 does in the output-on-screen mode.

Key 3 - Part 2

For output on the screen, the remainder of the variables and/o the resultant costs and production rates are displayed.

```
MPLE OUTPUT


ALYSIS OF VARIABLE CHANGES                BASE VALUES = EXAMPLE 1
                                          NEW VALUES  = EXAMPLE 1

                                                           BASE       NEW      PERCENT
                                                          VALUES     VALUES    CHANGE

#1 COST OF yarder                                 (DOLLARS) 125000     125000       0.0
#2 COST OF carriage                               (DOLLARS)   3000       3000       0.0
#1 RESIDUAL (PERCENT OF EQUIPMENT COST)                         20         20       0.0
#2 RESIDUAL (PERCENT OF EQUIPMENT COST)                         10         10       0.0
#1 DEPRECIATION PERIOD (YEARS)                                   7          7       0.0
#2 DEPRECIATION PERIOD (YEARS)                                   5          5       0.0
#1 REPAIRS & MAINTENANCE (PERCENT OF DEPRECIATION)              50         50       0.0
#2 REPAIRS & MAINTENANCE (PERCENT OF DEPRECIATION)              20         20       0.0
 ANNUAL INTEREST RATE (PERCENT)                              12.00      12.00       0.0
 TAX,LICENSE,INSURANCE, AND STORAGE (PERCENT)                 9.00       9.00       0.0
 OPERATING SEASON (DAYS WORKED/YEAR)                           200        200       0.0
 OPERATING TIME PER DAY (HOURS)                                8.0        8.0       0.0
 FUEL CONSUMPTION (GALLONS/HOUR)                              3.00       3.00       0.0
 FUEL COST (DOLLARS/GALLON)                                    .80        .80       0.0
 OIL AND LUBE (PERCENT OF FUEL CONSUMPTION)                      5          5       0.0
 OIL AND LUBE COST (DOLLARS/GALLON)                           1.50       1.50       0.0
 LINE COST (DOLLARS)                                          3600       3600       0.0
 LINE LIFE (HOURS)                                            1600       1600       0.0
 RIGGING COST (DOLLARS)                                       1000       1000       0.0
 RIGGING LIFE (HOURS)                                          800        800       0.0
 TIRE OR TRACK REPLACEMENT COST (DOLLARS)                        0          0       0.0
 TIRE OR TRACK LIFE (HOURS)                                      0          0       0.0
 TOTAL CREW WAGE (DOLLARS/HOUR)                              30.00      30.00       0.0
 FRINGE BENEFITS (PERCENT OF TOTAL CREW WAGE)                   30         30       0.0
 TRAVEL TIME PER DAY (HOURS)                                   .50        .50       0.0
 SUPERVISION AND OVERHEAD (PERCENT OF DIRECT LABOR)             20         20       0.0



 CUTTING UNIT AREA (ACRES)                                      35         35       0.0
 YIELD PER ACRE (CUNIT)                                      40.00      40.00       0.0
 DEFECT IN PIECES AS YARDED (PERCENT)                         0.00       0.00       0.0
 NUMBER OF YARDING ROADS IN UNIT                                11         11       0.0
 TIME PER ROAD CHANGE (HOURS)                                 1.00       1.00       0.0
 MOVE IN AND MOVE OUT COST (DOLLARS)                          2000       2000       0.0




NERSHIP COST (DOLLARS/HOUR)                                  20.30      20.30       0.0
ERATING COST (DOLLARS/HOUR)                                  59.71      59.71       0.0
                                                            ------     ------
CHINE RATE (DOLLARS/HOUR)                                    80.01      80.01       0.0

ODUCTION-RATE (CUNIT/HOUR)                                    5.00       5.00       0.0
AD CHANGE COST (DOLLARS/CUNIT)                                 .57        .57       0.0
VE IN AND OUT COST (DOLLARS/CUNIT)                            1.43       1.43       0.0


RDING COST (DOLLARS/CUNIT)                                   18.00      18.00       0.0
```

ure 9.--Printed output from key 1 (Print analysis) for EXAMPLE 1.

```
SAMPLE OUTPUT


ANALYSIS OF VARIABLE CHANGES                BASE VALUES = EXAMPLE 2
                                            NEW VALUES  = EXAMPLE 2

                                                                  BASE       NEW      PER
                                                                 VALUES     VALUES     CH

 1 #1 COST OF yarder                                 (DOLLARS)   125000     125000
   #2 COST OF carriage                               (DOLLARS)     3000       3000
 2 #1 RESIDUAL (PERCENT OF EQUIPMENT COST)                           20         20
   #2 RESIDUAL (PERCENT OF EQUIPMENT COST)                           10         10
 3 #1 DEPRECIATION PERIOD (YEARS)                                     7          7
   #2 DEPRECIATION PERIOD (YEARS)                                     5          5
 4 #1 REPAIRS & MAINTENANCE (PERCENT OF DEPRECIATION)                50         50
   #2 REPAIRS & MAINTENANCE (PERCENT OF DEPRECIATION)                20         20
 5  ANNUAL INTEREST RATE (PERCENT)                                12.00      12.00
 6  TAX,LICENSE,INSURANCE, AND STORAGE (PERCENT)                   9.00       9.00
 7  OPERATING SEASON (DAYS WORKED/YEAR)                             200        200
 8  OPERATING TIME PER DAY (HOURS)                                  7.0        7.0
 9  FUEL CONSUMPTION (GALLONS/HOUR)                                7.00       7.00
10  FUEL COST (DOLLARS/GALLON)                                       .80        .80
11  OIL AND LUBE (PERCENT OF FUEL CONSUMPTION)                        5          5
12  OIL AND LUBE COST (DOLLARS/GALLON)                             1.50       1.50
13  LINE COST (DOLLARS)                                             600        600
14  LINE LIFE (HOURS)                                              1600       1600
15  RIGGING COST (DOLLARS)                                         1000       1000
16  RIGGING LIFE (HOURS)                                            300        300
17  TIRE OR TRACK REPLACEMENT COST (DOLLARS)                          0          0
18  TIRE OR TRACK LIFE (HOURS)                                        0          0
19  TOTAL CREW WAGE (DOLLARS/HOUR)                                30.00      30.00
20  FRINGE BENEFITS (PERCENT OF TOTAL CREW WAGE                      30         30
21  TRAVEL TIME PER DAY (HOURS)                                     .50        .50
22  SUPERVISION AND OVERHEAD (PERCENT OF DIRECT [illegible]          20         20


25  AVG. VOLUME/PIECE AS BUCKED (CUNIT)                              .14        .14
26  DEFECT IN PIECES AS YARDED (PERCENT)                           6.00       6.00
27  NUMBER OF YARDING ROADS IN UNIT                                   1          1
28  AVERAGE NUMBER OF PIECES PER TURN                              3.50       3.50
29  AVERAGE NUMBER OF TURNS PER HOUR                              12.50      12.50
30  TIME PER ROAD CHANGE (HOURS)                                   6.00       6.00
31  MOVE IN AND MOVE OUT COST (DOLLARS)                               0          0



OWNERSHIP COST (DOLLARS/HOUR)                                     20.30      20.30
OPERATING COST (DOLLARS/HOUR)                                     59.71      59.71
                                                                  -----     ------
MACHINE RATE (DOLLARS/HOUR)                                       80.01      80.01

GROSS PRODUCTION RATE (CUNIT/HOUR)                                 6.13       6.13

NET PRODUCTION RATE (CUNIT/HOUR)                                   5.76       5.76


GROSS YARDING COST (DOLLARS/CUNIT)                                13.06      13.06

NET YARDING COST (DOLLARS/CUNIT)                                  13.90      13.90
```

Figure 10.--Printed output from key 1 (Print analysis) for EXAMPLE 2.

This routine allows changes to be made in the initial or "ba
values" and computes the resulting costs. The procedure, wit
sample input corresponding to EXAMPLE 2, is as follows:

1. The number of the variable to be changed = ? (1)
   This is the number that corresponds to each variable
   shown in figure 8 or 9. In this case, equipment cost.

2. For what piece (#) of equipment? (1)
   The yarder cost will be changed.

3. Do you want to delete this piece of equipment (YES or N
   (NO)

4. BASE VALUE = 125000 LAST VALUE = 125000 NEW VALUE =
   (200000)
   LAST VALUE refers to the previous new value entered.
   equals the base value unless a new value has been ent

5. Any more variable changes desired? (YES or NO) (Y

6. The number of the variable to be changed = ? (21)

   It is desired to change travel time per day (variable
   number 21).

7. BASE VALUE = .50 LAST VALUE = .50 NEW VALUE = ?

8. Any more variable changes desired (YES or NO) (YES)

9. The number of the variable to be changed = ? (1)
   It is desired to change equipment cost.

10. For what piece (#) of equipment? (2)
    The carriage cost will be changed.

11. Do you want to delete this piece of equipment? (YES or
    (YES)

12. Any more variable changes desired (YES or NO) (YES)

13. The number of the variable to be changed = ? (1)

14. For what piece (#) of equipment? (4)
    It is desired to add a piece of equipment to the exis
    pieces in the base values. Since there are only two,
    pieces are only added in sequence, the following mess
    will be displayed:
    "Note: the piece # you selected is changed to 3.
    Press CONT to proceed."

(RIGGING HARDWARE)

16. For piece #3: Cost of RIGGING HARDWARE (dollars) = ?
(5000)

17. For piece #3: Residual value (percent of equipment cost)
(10)

18. For piece #3: Depreciation period (years) = ? (0)
A depreciation period of zero years is not allowed, and
following message is displayed for 6 seconds:
"The value of 0 may not be entered for this variable!
It must be re-entered."

19. For piece #3: Depreciation period (years) = ? (4)

20. For piece #3: Repairs and maintenance (percent of equipme
depreciation = ? (0)

21. Any more variable changes desired? (YES or NO) (NO)

22. Enter identifier for NEW VALUES (25 characters maximum)
(EXAMPLE 2 UPDATE)
If nothing is entered (i.e., only the CONT key is presse
the identifier for the new values will be the same as t
for the base values. However, once an identifier is entered, when step 22 is encountered in a subsequent VARIABLE CHANGES routine and nothing is entered, the identifier for the new values will remain unchanged.

23. Enter a new heading for all output (70 characters maximum
If nothing is entered (i.e., only the CONT key is presse
the existing heading will remain unchanged.

The variable changes are complete. Output can be obtained by pressing key 1, key 2, or key 3. For output on the printer, pressing key 1 yields the results shown in figure 11.

```
SAMPLE OUTPUT


ANALYSIS OF VARIABLE CHANGES                BASE VALUES = EXAMPLE 2
                                            NEW VALUES  = EXAMPLE 2 UPDATE

                                                                 BASE      NEW
                                                                VALUES    VALUES

1 #1 COST OF yarder                                 (DOLLARS)  125000    200000
  #2 COST OF carriage                               (DOLLARS)    3000         0
  #3 COST OF rigging hardware                       (DOLLARS)       0      5000
2 #1 RESIDUAL (PERCENT OF EQUIPMENT COST)                          20        20
  #2 RESIDUAL (PERCENT OF EQUIPMENT COST)                          10         0
  #3 RESIDUAL (PERCENT OF EQUIPMENT COST)                           0        10
3 #1 DEPRECIATION PERIOD (YEARS)                                    7         7
  #2 DEPRECIATION PERIOD (YEARS)                                    5         0
  #3 DEPRECIATION PERIOD (YEARS)                                    0         4
4 #1 REPAIRS & MAINTENANCE (PERCENT OF DEPRECIATION)               50        50
  #2 REPAIRS & MAINTENANCE (PERCENT OF DEPRECIATION)               20         0
  #3 REPAIRS & MAINTENANCE (PERCENT OF DEPRECIATION)                0         0
5  ANNUAL INTEREST RATE (PERCENT)                               12.00     12.00
6  TAX,LICENSE,INSURANCE, AND STORAGE (PERCENT)                  9.00      9.00
7  OPERATING SEASON (DAYS WORKED/YEAR)                            200       200
8  OPERATING TIME PER DAY (HOURS)                                 8.0       8.0
9  FUEL CONSUMPTION (GALLONS/HOUR)                               3.00      3.00
10 FUEL COST (DOLLARS/GALLON)                                     .80       .80
11 OIL AND LUBE (PERCENT OF FUEL CONSUMPTION)                       5         5
12 OIL AND LUBE COST (DOLLARS/GALLON)                            1.50      1.50
13 LINE COST (DOLLARS)                                           3600      3600
14 LINE LIFE (HOURS)                                             1600      1600
15 RIGGING COST (DOLLARS)                                        1000      1000
16 RIGGING LIFE (HOURS)                                           800       800
17 TIRE OR TRACK REPLACEMENT COST (DOLLARS)                          0         0
18 TIRE OR TRACK LIFE (HOURS)                                       0         0
19 TOTAL CREW WAGE (DOLLARS/HOUR)                               30.00     30.00
20 FRINGE BENEFITS (PERCENT OF TOTAL CREW WAGE)                    30        30
21 TRAVEL TIME PER DAY (HOURS)                                    .50      0.00
22 SUPERVISION AND OVERHEAD (PERCENT OF DIRECT LABOR)              20        20



25 AVG. VOLUME/PIECE AS BUCKED (CUNIT)                            .14       .14
26 DEFECT IN PIECES AS YARDED (PERCENT)                          6.00      6.00
27 NUMBER OF YARDING ROADS IN UNIT                                  1         1
28 AVERAGE NUMBER OF PIECES PER TURN                             3.50      3.50
29 AVERAGE NUMBER OF TURNS PER HOUR                             12.50     12.50
30 TIME PER ROAD CHANGE (HOURS)                                  0.00      0.00
31 MOVE IN AND MOVE OUT COST (DOLLARS)                              0         0




OWNERSHIP COST (DOLLARS/HOUR)                                   20.30     32.67
OPERATING COST (DOLLARS/HOUR)                                   59.71     60.07
                                                               ------    ------
MACHINE RATE (DOLLARS/HOUR)                                     80.01     92.74

GROSS PRODUCTION RATE (CUNIT/HOUR)                               6.13      6.13

NET PRODUCTION RATE (CUNIT/HOUR)                                 5.76      5.76


GROSS YARDING COST (DOLLARS/CUNIT)                              13.06     15.14


NET YARDING COST (DOLLARS/CUNIT)                                13.90     16.11
```

Figure 11.--Printed output from key 1 (Print analysis) for EXAMPLE 2.

The values of ownership cost, operating cost, machine rate, g
volume/hour (i.e., gross production rate), and net volume/hou
(i.e., net production rate) can be changed with these keys. A
example, the output in figure 11 is modified by pressing key
and changing gross volume/hour as follows:

1. GROSS VOLUME/HR: BASE VALUE = 6.13 LAST VALUE = 6.13
   NEW VALUE = ?? (8)

2. Enter identifier for NEW VALUES (25 characters maximum)
   If nothing is entered (i.e., only the CONT key is pressed), the existing identifier for the new values w
   remain unchanged.

3. Enter a new heading for all output (25 characters maximu
   If nothing is entered (i.e., only the CONT key is pres
   the existing heading will remain unchanged.

For output on the printer, the results shown in figure 12 are generated.

```
PLE OUTPUT


LYSIS WITH NEW VALUE OF                [illegible]
SS VOLUME/HR                           [illegible]

                                              [illegible]      [illegible]     PERC
                                              [illegible]      [illegible]     CHA


ERSHIP COST (DOLLARS/HOUR)                    [illegible]      [illegible]     [illegible]
RATING COST (DOLLARS/HOUR)                    [illegible]      [illegible]

HINE RATE (DOLLARS/HOUR)                      [illegible]      [illegible].24  15

SS PRODUCTION RATE (CUNIT/HOUR)               [illegible]      [illegible]     30

 PRODUCTION RATE (CUNIT/HOUR)                 5.[illegible]    5.76            0


SS YARDING COST (DOLLARS/CUNIT)               [illegible]      11.59           -11

 YARDING COST (DOLLARS/CUNIT)                 13.98            16.11           15
```

*ure 12.--Printed output from key 14 (Change gross volume/hour)
EXAMPLE 2.*

When a peripheral plotter is not available or it is desired t
first view the yarding cost-production rate curve on the scre
this key must be pressed. Key 10 or key 26 must be pressed to
the actual plot.

Key 9 - Plot on Plotter

The yarding cost-production rate curve will be plotted direct
the plotter. Physical plotting limits should be set to 6-1/4
horizontally and vertically. Key 10 or key 26 must be pressed
make the actual plot.

If this key is pressed, the plotter must be turned on before proceeding.

Key 10 - Axes and Plot

This key is used to construct the axes, label them, and plot
yarding cost-production rate curves. Key 8 or key 9 must be pressed before this key. The procedures, with sample inputs corresponding to EXAMPLE 2 UPDATE (figure 12) follow. It is assumed that key 8 has been pressed.

1. Do you want to plot gross rather than net values? (YES o
   (YES)

   Step 1 is skipped if gross and net values are equal; i
   if percent defects is zero.

2. Want to define range of production rate and yarding cost
   other than 10 and 20 (YES/NO)? (YES)

   The values displayed represent the limits of the X and
   axes respectively, rounded up to the nearest whole val
   10.

   If (NO) is answered, skip step 3.

3. Enter: maximum production rate (X axis), maximum yarding
   (Y axis) (10, 30)

   Any values may be entered but the limits will be round
   to the nearest whole value of 10. This input is useful
   changing the scale of the plot, or when subsequent cur
   will be added to the current plot (key 26 - Plot only)

4. Enter: 0 to plot BASE VALUES; 1 to plot NEW VALUES; 2 t
   plot both (2)

   Either or both curves can be plotted on the axes.

Key 26 - Plot Only

Up to nine curves can be plotted on the same axes. The curve(s) plotted with key 10 (Axes and Plot) and any ot plotted with key 26 (Plot only) are replotted along wit current base and/or new values on the axes originally d step 4, key 10. Each curve is plotted using a differen type. Input is made in response to the following prompt

Enter: 0 to plot BASE VALUES; 1 to plot NEW VALUES; 2 t

A new curve can be generated only if one or more chan made through key 0, 11, 12, 13, 14, or 15 prior to pr key.

Key 24 - Hard Copy of Plot

A hard copy on the internal printer is made if the yard production rate curve was plotted on the screen. The cu representing the new and base values from EXAMPLE 2 UPD (fig. 12) are reproduced on the internal printer as sho figure 13.

Key 4 - New Values Replaced by Base Values

The new values are replaced by the base values, includi identifier and resultant costs and production rates. Th production rate changes made with keys 11, 12, 13, 14, on the new value, not the base value. Thus, if it is de see the effect on yarding cost of changing only ownersh subsequently to see the effect of changing only operati key 4 must be pressed after key 11 and before key 12.

Key 20 - Base Values Replaced by New Values

The base values are replaced by the new values, includi identifier and resultant costs and production rates.

Key 7 - Rewind T15

Rewind the T15 tape cartridge.

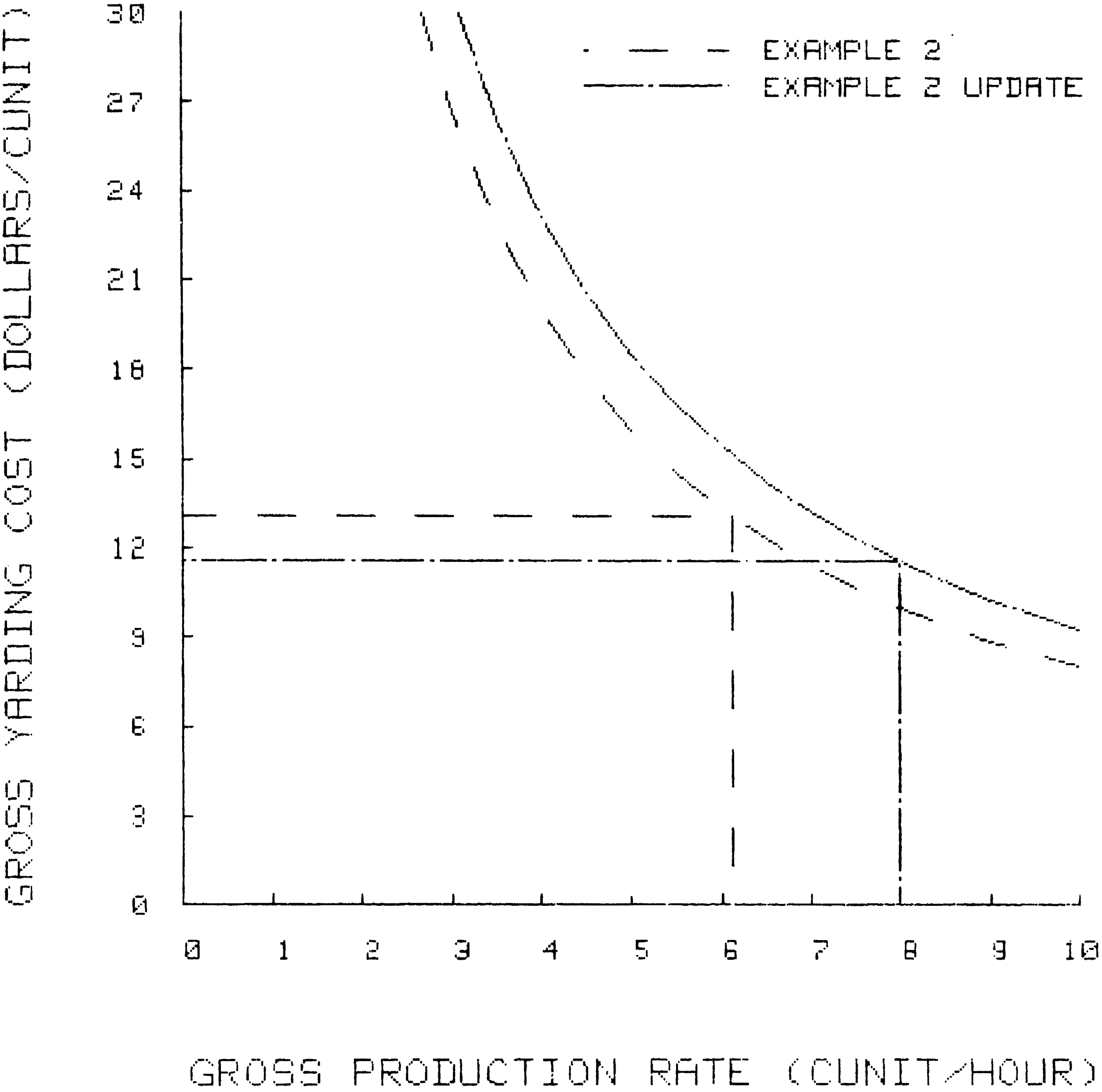

Figure 13.--Printed output from key 24 (Hard copy of plot) for EXAMPLE 2.

Program Listings

97/67 Program

```
     *LBLA       21 11
      STOD       35 14
        R↓         -31
      ENT↑         -21
        R↓         -31
        R↓         -31
      ENT↑         -21
        R↑       16-31
         %          55
      STO6       35 06
         -         -45
      STOB       35 12
      RCLD       36 14
         ÷         -24
      STOC       35 13
       RTN          24
     *LBLA       21 11
      STO4       35 04
       X⇄Y         -41
         x         -35
      STO9       35 09
        R↓         -31
      RCLD       36 14
         1          01
         +         -55
      RCLB       36 12
         x         -35
         2          02
         ÷         -24
      RCLD       36 14
         ÷         -24
      RCL6       36 06
         +         -55
      STOA       35 11
       X⇄Y         -41
         1          01
         %          55
       X⇄Y         -41
        R↓         -31
         x         -35
      STO0       35 00
        R↓         -31
         1          01
         %          55
      RCLA       36 11
         x         -35
      RCLC       36 13
      RCL0       36 00
         +         -55
         +         -55
      RCL9       36 09
         ÷         -24
      STO5       35 05
      PRTX         -14
       RTN          24
     *LBLC       21 13
```

```
057       X⇄Y          -41
058      STO2        35 02
059         x          -35
060      STO0        35 00
061        R↓          -31
062      RCLC        36 13
063         %           55
064      RCL9        36 09
065         ÷          -24
066      ST+0     35-55 00
067       RTN           24
068     *LBLC        21 13
069      X=0?        16-43
070      GTO1        22 01
071         ÷          -24
072      ST+0     35-55 00
073     *LBL2        21 02
074        R↓          -31
075         %           55
076      RCL2        36 02
077         x          -35
078      ST+0     35-55 00
079       RTN           24
080     *LBLC        21 13
081      X=0?        16-43
082      GTO3        22 03
083         ÷          -24
084      ST+0     35-55 00
085     *LBL4        21 04
086        R↓          -31
087      X=0?        16-43
088      GTO5        22 05
089         ÷          -24
090     *LBL5        21 05
091      ST+0     35-55 00
092       RTN           24
093     *LBLC        21 13
094      STO1        35 01
095        R↓          -31
096      RCL4        36 04
097         ÷          -24
098       X⇄Y          -41
099         1           01
100         %           55
101       X⇄Y          -41
102        R↓          -31
103         1           01
104         +          -55
105         +          -55
106         x          -35
107      RCL1        36 01
108         %           55
109         +          -55
110      ST+0     35-55 00
111      RCL0        36 00
112      PRTX          -14
```

```
113       SPC        16-11
114      RCL5        36 05
115         +          -55
116      STO6        35 06
117      PRTX          -14
118       SPC        16-11
119       SPC        16-11
120       RTN           24
121     *LBL1        21 01
122      ST+0     35-55 00
123        R↓          -31
124      GTO2        22 02
125     *LBL3        21 03
126      ST+0     35-55 00
127        R↓          -31
128      GTO4        22 04
129     *LBLD        21 14
130         x          -35
131         x          -35
132      STOD        35 14
133       RTN           24
134     *LBLD        21 14
135      GTO6        22 06
136     *LBLE        21 15
137      STOD        35 14
138       RTN           24
139     *LBLE        21 15
140     *LBL6        21 06
141      STOA        35 11
142        R↓          -31
143       X⇄Y          -41
144         1           01
145         -          -45
146         x          -35
147      RCL6        36 06
148         x          -35
149      STOB        35 12
150        R↑        16-31
151         1           01
152         %           55
153         1           01
154       X⇄Y          -41
155         -          -45
156      STOC        35 13
157       RTN           24
158     *LBLE        21 15
159     *LBL9        21 09
160         x          -35
161      X=0?        16-43
162      GTO7        22 07
163      ENT↑          -21
164      RCLA        36 11
165       X⇄Y          -41
166      ENT↑          -21
167        R↓          -31
168         ÷          -24
```

```
169      STOA      3
170        R↓
171        R↓
172      RCLB      3
173       X⇄Y
174         ÷
175      STOB      3
176      GTO8      2
177     *LBL2      2
178         0
179      STOA      3
180      STOB      3
181     *LBL8      2
182      RCL6      3
183      RCLD      3
184      PRTX
185         ÷
186      STO1      3
187      RCLD      3
188      RCLC      3
189         x
190      PRTX
191       SPC      1
192      RCL6      3
193       X⇄Y
194         ÷
195      STO2      3
196      RCLB      3
197      PRTX
198      ST+1   35-5
199      RCLA      3
200      PRTX
201       SPC      1
202      ST+1   35-5
203      RCLC      3
204        R↓
205       X⇄Y
206      RCLC      3
207         ÷
208      PRTX
209      ST+2   35-5
210        R↓
211      RCLC      3
212         ÷
213      PRTX
214      ST+2   35-5
215       SPC      1
216       SPC      1
217      RCL1      3
218      PRTX
219      RCL2      3
220      PRTX
221       SPC      1
222       RTN
223     *LBLD      2
224      GTO9      2
```

9845 Program

```
10    ! ***** YCOST ***** RON MIFFLIN ***** PNW-SEATTLE,USFS ***** NOV
20    !
30    LOAD KEY "K-COST"
40    INPUT "Want output on the screen? (YES or NO)  -  If NO, output
the printer.",B$
50    IF B$[1,1]="Y" THEN 90
60    IF B$[1,1]<>"N" THEN 40
70    P1=0
80    GOTO 100
90    P1=16
100   B$=""
110   PRINTER IS P1
120   A(32)=B(32)=1
130   DATA 1,3,5,7,8,9,10,11,12,19,23,24,25,27,28,29
140   GCLEAR
150   SHORT A(39),B(39),C(9,7),D(9,7),E(40),Z7(2),Z8(2)
160   SHORT A,A1,A2,A3,A4,A5,A6,A7,A8,A9,B,D,E,F,H,H1,I,J,K,K1,K2,K3,L,
P,P1,Q,R,S2,T,U,W,W1,X,X1,Z5
170   DIM A$[100],B$[100],C$[100],D$[100],E$[15],F$[100],G$(5)[100],H$
180   DEFAULT ON
190   INPUT "Do you want a heading for all output? (YES or NO)",B$
200   IF B$[1,1]="Y" THEN 240
210   IF B$[1,1]<>"N" THEN 190
220   H$=B$=""
230   GOTO 330
240   INPUT "Enter heading (in any form desired up to 70 characters ma
250   IF LEN(H$)<=70 THEN 310
260   BEEP
270   FIXED 0
280   DISP "Sorry, you're";LEN(H$)-70;"characters over the limit of 70
n: heading = ";
290   INPUT H$
300   GOTO 250
310   B$=""
320   PRINT H$,LIN(2)
330   PRINT "YARDING COST PROGRAM",LIN(2)
340   INPUT "Number of pieces of equipment to depreciate = ?",U
350   M=U
360   IF U<=9 THEN 400
370   BEEP
380   INPUT "9 pieces maximum! Try again: number of pieces of equipmen
iate = ?",U
390   GOTO 350
400   IF U<>0 THEN 440
410   BEEP
420   INPUT "Min. of 1 required! Try again: number of pieces of equipm
eciate = ?",U
430   GOTO 350
440   IF U<6 THEN 480
450   BEEP
460   DISP "Screen output may be incomplete for VARIABLE CHANGES & PRI
 routines!"
```

```
470  WAIT 7000
480  FIXED 0
490  IF U>1 THEN 680
500  INPUT "Enter equipment identifier (30 characters maximum).",G$(1)
510  IF LEN(G$(1))<=30 THEN 550
520  BEEP
530  INPUT "30 characters maximum!  Try again: enter equipment identif
540  GOTO 510
550  DISP "Cost of ";G$(1);" (dollars) = ";
560  INPUT C(1,1)
570  IF C(1,1)<>0 THEN 600
580  GOSUB 2230
590  GOTO 500
600  INPUT "Residual (percent of equipment cost) = ?",C(1,2)
610  INPUT "Depreciation period (years) = ?",C(1,3)
620  IF C(1,3)<>0 THEN 650
630  GOSUB 2230
640  GOTO 610
650  DISP "Repairs and maintenance (percent of equipment depreciation,
(100-C(1,2))/100/C(1,3);"per year) =";
660  INPUT C(1,4)
670  GOTO 910
680  FOR X=1 TO U
690  DISP "For piece #";X;":  Equipment identifier (30 characters maxi
700  INPUT G$(X)
710  IF LEN(G$(X))<=30 THEN 760
720  BEEP
730  DISP "30 characters maximum!  Try again: for piece #";X;": equipm
fier = ";
740  INPUT G$(X)
750  GOTO 710
760  DISP "For piece #";X;":  Cost of ";G$(X);" (dollars) = ";
770  INPUT C(X,1)
780  IF C(X,1)<>0 THEN 810
790  GOSUB 2230
800  GOTO 760
810  DISP "For piece #";X;":  Residual value (percent of equipment cos
820  INPUT C(X,2)
830  DISP "For piece #";X;":  Depreciation period (years) = ";
840  INPUT C(X,3)
850  IF C(X,3)<>0 THEN 880
860  GOSUB 2230
870  GOTO 830
880  DISP "For piece #";X;":  Repairs & maintenance (pct of equip. dep
,1)*(100-C(X,2))/100/C(X,3);"per yr)=";
890  INPUT C(X,4)
900  NEXT X
910  INPUT "Annual interest rate (percent) = ?",A(5)
920  MAT D=C
930  A=D=M1=0
940  FOR X=1 TO U
950  D(X,5)=D(X,1)*(100-D(X,2))/100      ! depreciable value
960  IF D(X,3)<>0 THEN 990
```

```
970  D(X,6)=0
980  GOTO 1000
990  D(X,6)=D(X,5)/D(X,3)      ! equipment depreciation
1000 D=D+D(X,6)      ! total equipment depreciation
1010 IF D(X,3)<>0 THEN 1040
1020 D(X,7)=D(X,1)*D(X,2)/100      ! average annual investment
1030 GOTO 1050
1040 D(X,7)=D(X,5)*(D(X,3)+1)/(2*D(X,3))+D(X,1)*D(X,2)/100   ! avg
1050 A=A+D(X,7)      ! total average annual investment
1060 IF P=0 THEN 1080
1070 M1=M1+D(X,4)*D(X,6)/(B(7)*B(8)*100)      ! total repairs & mai
1080 NEXT X
1090 IF P=1 THEN 2470      ! go to routine to calculate production
1100 DISP "Taxes,license,insurance, & storage (pct of avg. ann. in
er yr)=";
1110 INPUT A(6)
1120 INPUT "Operating season (days worked/year) = ?",A(7)
1130 IF A(7)<>0 THEN 1160
1140 GOSUB 2230
1150 GOTO 1120
1160 INPUT "Operating time per day (hours) = ?",A(8)
1170 IF A(8)<>0 THEN 1200
1180 GOSUB 2230
1190 GOTO 1160
1200 INPUT "Fuel consumption (gallons/hour) = ?",A(9)
1210 IF A(9)<>0 THEN 1240
1220 GOSUB 2230
1230 GOTO 1200
1240 INPUT "Fuel cost (dollars/gallon) = ?",A(10)
1250 IF A(10)<>0 THEN 1280
1260 GOSUB 2230
1270 GOTO 1240
1280 INPUT "Oil and lube consumption (percent of fuel consumption)
1290 IF A(11)<>0 THEN 1320
1300 GOSUB 2230
1310 GOTO 1280
1320 INPUT "Oil and lube cost (dollars/gallon) = ?",A(12)
1330 IF A(12)<>0 THEN 1360
1340 GOSUB 2230
1350 GOTO 1320
1360 INPUT "Line cost (dollars) = ?",A(13)
1370 IF A(13)=0 THEN 1390
1380 INPUT "Estimated line life (hours) = ?",A(14)
1390 INPUT "Rigging cost (dollars) = ?",A(15)
1400 IF A(15)=0 THEN 1420
1410 INPUT "Estimated rigging life (hours) = ?",A(16)
1420 INPUT "Tire or track replacement cost (dollars) = ?",A(17)
1430 IF A(17)=0 THEN 1450
1440 INPUT "Estimated tire or track life (hours) = ?",A(18)
1450 INPUT "Total crew wage (base wage for all crew members, doll
A(19)
1460 IF A(19)<>0 THEN 1490
1470 GOSUB 2230
```

```
1480 GOTO 1450
1490 INPUT "Fringe benefits (percent of total crew wage) = ?",A(20)
1500 INPUT "Travel time per day (hours) = ?",A(21)
1510 DISP "Supervision and overhead (percent of direct labor, $";A(19)*(
100+A(21)/A(8));"per hour) = ";
1520 INPUT A(22)
1530 INPUT "Volume units = ? (5 characters maximum)",A$
1540 IF LEN(A$)<=5 THEN 1580
1550 BEEP
1560 INPUT "5 characters maximum! Try again: volume units = ?",A$
1570 GOTO 1540
1580 INPUT "Is known production rate to be entered? (YES or NO)",B$
1590 IF B$[1,1]="N" THEN 1980
1600 IF B$[1,1]<>"Y" THEN 1580
1610 INPUT "Percent defect in pieces as yarded = ?",A(26)
1620 INPUT "Number of yarding roads in unit = ?",A(27)
1630 IF A(27)>1 THEN 1670
1640 IF A(27)<>0 THEN 1680
1650 GOSUB 2230
1660 GOTO 1620
1670 INPUT "Time per road change (hours) = ?",A(30)
1680 B$=""
1690 DISP "Production rate (";LWC$(A$);"/hour) = ";
1700 INPUT A(36)      ! gross production rate
1710 IF A(36)<>0 THEN 1740
1720 GOSUB 2230
1730 GOTO 1680
1740 B(36)=A(36)
1750 A(37)=B(37)=A(36)*(100-A(26))/100      ! net production rate
1760 INPUT "Move in and move out cost (dollars) = ?",A(31)
1770 IF A(31)=0 THEN 1780
1780 IF (A(27)>1) AND (A(30)<>0) THEN 1800
1790 IF A(31)=0 THEN 1960
1800 GOSUB 1830
1810 GOTO 1960
1820 !
1830 ! Subroutine for entering area & yield
1840 !
1850 INPUT "Cutting unit area (acres) = ?",A(23)
1860 IF A(23)<>0 THEN 1890
1870 GOSUB 2230
1880 GOTO 1830
1890 DISP "Yield per acre (";LWC$(A$);") = ";
1900 INPUT A(24)
1910 IF A(24)<>0 THEN 1940
1920 GOSUB 2230
1930 GOTO 1890
1940 RETURN
1950 !
1960 Z5=1     ! flag to print production data
1970 GOTO 2290
1980 B$=""
1990 DISP "Average volume per piece as bucked (";LWC$(A$);") = ";
```

```
2000 INPUT A(25)
2010 IF A(25)<>0 THEN 2040
2020 GOSUB 2230
2030 GOTO 1990
2040 INPUT "Percent defect in pieces as yarded = ?",A(26)
2050 INPUT "Number of yarding roads in unit = ?",A(27)
2060 IF A(27)<>0 THEN 2090
2070 GOSUB 2230
2080 GOTO 2050
2090 INPUT "Average number of pieces per turn = ?",A(28)
2100 IF A(28)<>0 THEN 2130
2110 GOSUB 2230
2120 GOTO 2090
2130 INPUT "Average number of turns per hour = ?",A(29)
2140 IF A(29)<>0 THEN 2170
2150 GOSUB 2230
2160 GOTO 2130
2170 IF A(27)<=1 THEN 2190
2180 INPUT "Time per road change (hours) = ?",A(30)
2190 INPUT "Move in and move out cost (dollars) = ?",A(31)
2200 IF (A(27)>1) AND (A(30)<>0) OR (A(31)<>0) THEN GOSUB 1830
2210 GOTO 2290
2220 !
2230 ! routine to warn against input of 0 for variable value
2240 BEEP
2250 DISP "The value of 0 may not be entered for this variable! It mus
tered."
2260 WAIT 5000
2270 RETURN
2280 !
2290 IF A(31)<>0 THEN 2320
2300 Z7(1)=Z7(2)=0      ! move cost
2310 GOTO 2330
2320 Z7(1)=Z7(2)=A(31)/A(23)/A(24)      ! move cost
2330 INPUT "Enter identifier (25 characters maximum)",C$
2340 IF LEN(C$)<=25 THEN 2380
2350 BEEP
2360 INPUT "25 characters maximum! Try again: enter identifier.",C$
2370 GOTO 2340
2380 D$=C$
2390 MAT B=A     ! new values = base values
2400 MAT D=C     ! new values = base values
2410 FOR X=1 TO U
2420 C(X,5)=C(X,1)*(100-C(X,2))/100       ! depreciable value
2430 C(X,6)=C(X,5)/C(X,3)       ! equipment depreciation
2440 M1=M1+C(X,4)*C(X,6)/(A(7)*A(8)*100)      ! total repairs & mainter
2450 NEXT X
2460 !
2470 ! Routine to caluculate production rate and costs
2480 !
2490 B(33)=(D+A*(B(5)+B(6))/100)/B(7)/B(8)      ! ownership cost
2500 L=R=T=0
2510 IF (B(13)=0) OR (B(14)=0) THEN 2530
```

```
2520 L=B(13)/B(14)
2530 IF (B(15)=0) OR (B(16)=0) THEN 2550
2540 R=B(15)/B(16)
2550 IF (B(17)=0) OR (B(18)=0) THEN 2570
2560 T=B(17)/B(18)
2570 Q=(1+B(22)/100)*(B(19)*(1+B(20)/100+B(21)/B(8)))
2580 B(34)=M1+B(9)*B(10)+B(11)*B(9)*B(12)/100+L+R+T+Q      ! operating
2590 B(35)=B(33)+B(34)       ! machine rate
2600 IF (B(30)=0) OR (B(27)<=1) THEN 2630
2610 Z8(2)=(B(27)-1)*B(30)*B(35)/B(23)/B(24)       ! setting change cos
2620 GOTO 2640
2630 Z8(2)=0       ! setting change cost
2640 IF B(31)=0 THEN 2670
2650 Z7(2)=B(31)/B(23)/B(24)       ! move cost
2660 GOTO 2680
2670 Z7(2)=0       ! move cost
2680 IF Z5=1 THEN 2700
2690 B(36)=B(25)*B(28)*B(29)       ! gross prod. rate if prod. rate unk
2700 B(37)=B(36)*(100-B(26))/100       ! net production rate
2710 B(38)=B(35)/B(36)+Z7(2)+Z8(2)       ! gross yarding cost
2720 B(39)=B(35)/B(37)+(Z7(2)+Z8(2))/((100-B(26))/100)       ! net yard
2730 IF P=1 THEN 5210  ! return to VARIABLE CHANGES routine
2740 MAT A=B
2750 Z7(1)=Z7(2)
2760 Z8(1)=Z8(2)
2770 IF C$="" THEN 2800
2780 IMAGE "Values are for ",18A,/
2790 PRINT USING 2780;C$
2800 IMAGE /,"OWNERSHIP COST = $",4D.DD,"/HOUR"
2810 PRINT USING 2800;A(33)
2820 IMAGE "OPERATING COST = $",4D.DD,"/HOUR"
2830 PRINT USING 2820;A(34)
2840 PRINT SPA(17),"-------------"
2850 IMAGE "MACHINE RATE =   $",4D.DD,"/HOUR"
2860 PRINT USING 2850;A(35)
2870 IF (A(26)<>0) OR (B(26)<>0) THEN 2990
2880 IMAGE /,"PRODUCTION RATE =",4D.DDX,5A,"/HOUR",/
2890 PRINT USING 2880;A(36),A$
2900 IF (A(30)=0) OR (A(27)=1) THEN 2930      ! ie, no setting change
2910 IMAGE "ROAD CHANGE COST = $",3D.DD,"/",5A
2920 PRINT USING 2910;Z8(1),A$
2930 IF A(31)=0 THEN 2960
2940 IMAGE "MOVE IN AND OUT COST =  $",3D.DD,"/",5A
2950 PRINT USING 2940;Z7(1),A$
2960 IMAGE /,/,"YARDING COST = $",4D.DD,"/",5A
2970 PRINT USING 2960;A(38),A$
2980 GOTO 3210
2990 IMAGE /,"GROSS PRODUCTION RATE =",4D.DDX,5A,"/HOUR"
3000 PRINT USING 2990;A(36),A$
3010 IMAGE /,"NET PRODUCTION RATE =  ",4D.DDX,5A,"/HOUR",/
3020 PRINT USING 3010;A(37),A$
3030 IF (A(30)=0) OR (A(27)=1) THEN 3060
3040 IMAGE "GROSS ROAD CHANGE COST =   $",3D.DD,"/",5A
```

```
050 PRINT USING 3040;Z8(1),A$
060 IF A(31)=0 THEN 3090
070 IMAGE "GROSS MOVE IN AND OUT COST = $",3D.DD,"/",5A
080 PRINT USING 3070;Z7(1),A$
090 IF (A(30)=0) OR (A(27)=1) THEN 3120
100 IMAGE /,"NET ROAD CHANGE COST =   $",3D.DD,"/",5A
110 PRINT USING 3100;Z8(1)/(100-A(26))*100,A$
120 IF A(31)=0 THEN 3170
130 IF (A(30)<>0) AND (A(27)<>1) THEN 3150
140 PRINT
150 IMAGE "NET MOVE IN AND OUT COST = $",3D.DD,"/",5A
160 PRINT USING 3150;Z7(1)/(100-A(26))*100,A$
170 IMAGE /,/,"GROSS YARDING COST = $",4D.DD,"/",5A
180 PRINT USING 3170;A(38),A$
190 IMAGE /,"NET YARDING COST =   $",4D.DD,"/",5A
200 PRINT USING 3190;A(39),A$
210 IF P1=16 THEN 3230
220 PRINT USING "/,/,/,/"
230 PAUSE
240 GOTO 3230
250 !
260 ! ********** KEY 0 (VARIABLE CHANGES) **********
270 !
280 PRINTER IS 16
290 PRINT "VARIABLE CHANGES Routine",LIN(2)
300 PRINTER IS P1
310 B$=""
320 F=0
330 INPUT "The number of the variable to be changed = ?",N
340 FOR X=1 TO 15
350 READ B      ! read data from statement 65
360 IF N<>B THEN 3390
370 F=1
380 GOTO 3400
390 NEXT X
400 RESTORE 130
410 IF Z5=0 THEN 3470
420 IF (N<>25) AND (N<>28) AND (N<>29) THEN 3470
430 BEEP
440 DISP "This variable cannot be changed in the 'known production' rate
450 WAIT 6000
460 GOTO 3320
470 IF (N<=31) AND (N>0) THEN 3520
480 BEEP
490 INPUT "Variables are numbered 1-31! Try again: number of the variable
hanged = ?",N
500 F=0
510 GOTO 3340
520 IF N>4 THEN 4020
530 INPUT "For what piece (#) of equipment ?",N1
540 IF (N1<=9) AND (N>0) THEN 3580
550 BEEP
```

```
3560 INPUT "Equipment pieces are numbered 1-9! Try again: for what pi
equipment ?",N1
3570 GOTO 3540
3580 IF N1<=U THEN 3770     ! see if a new piece is to be added
3590 IF N1-U=1 THEN 3640     ! see if new piece # follows last piece
3600 BEEP
3610 FIXED 0
3620 DISP "Note: the piece # you selected is changed to";U+1;". Press
ocede."
3630 PAUSE
3640 N1=U=U+1
3650 IF N1<6 THEN 3690
3660 BEEP
3670 DISP "Screen output may be incomplete for VARIABLE CHANGES & PRI
 routines!"
3680 WAIT 7000
3690 IF N<>1 THEN 3890
3700 FIXED 0
3710 DISP "Equipment identifier (30 characters maximum) for piece #";
3720 INPUT G$(N1)
3730 IF LEN(G$(N1))<=30 THEN 3890
3740 BEEP
3750 INPUT "30 characters maximum!  Try again: enter equipment identi
1)
3760 GOTO 3730
3770 IF N<>1 THEN 3890
3780 IF (N1<=M) AND (D(N1,1)=0) THEN 3890
3790 ! Routine to allow equipment to be deleted
3800 !
3810 INPUT "Do you want to delete this piece of equipment? (YES or NO
3820 IF B$[1,1]="N" THEN 3890
3830 IF B$[1,1]<>"Y" THEN 3810
3840 D(N1,1)=D(N1,2)=D(N1,3)=D(N1,4)=0
3850 IF U<=M THEN 4480      ! see if deleted piece was previously an a
3860 U=U-1       ! reduce number of pieces by one
3870 GOTO 4480
3880 !
3890 IF (D(N1,1)<>0) OR (D(N1,2)<>0) OR (D(N1,3)<>0) OR (D(N1,4)<>0)
3900 GOSUB 4670
3910 GOTO 4480
3920 FIXED 0
3930 DISP "BASE VALUE =";C(N1,N);"   LAST VALUE =";D(N1,N);"   NEW VA
3940 INPUT J
3950 IF (F<>0) AND (J=0) THEN 3980
3960 D(N1,N)=J
3970 GOTO 4480
3980 BEEP
3990 DISP "The value of 0 may not be entered for this variable!  It m
ntered."
4000 WAIT 6000
4010 GOTO 3920
4020 FIXED 2
4030 DISP "BASE VALUE =";A(N);"   LAST VALUE =";B(N);"   NEW VALUE =
4040 INPUT J
4050 IF (F<>0) AND (J=0) THEN 4080
4060 B(N)=J
4070 GOTO 4160
4080 IF (N<>23) AND (N<>24) THEN 4120
4090 IF (B(27)>1) AND (B(30)<>0) THEN 4120
4100 IF B(31)<>0 THEN 4120
4110 GOTO 4060
4120 BEEP
4130 DISP "A value of 0 may not be entered for this variable!  It must
ered."
4140 WAIT 6000
4150 GOTO 4020
4160 IF (N<>27) AND (N<>30) AND (N<>31) THEN 4480
4170 IF N<>27 THEN 4240
4180 IF (B(30)<>0) OR (B(27)<=1) THEN 4320
4190 INPUT "Time per setting change (hours) = ?",B(30)
4200 IF B(30)>0 THEN 4320
4210 BEEP
4220 INPUT "You must enter a value greater than 0!  Try again: time per
chg (hr) = ?",B(30)
4230 GOTO 4200
4240 IF N<>30 THEN 4320
4250 IF (B(27)>1) OR (B(30)=0) THEN 4320
4260 INPUT "Number of settings in unit = ?",B(27)
4270 IF B(27)>1 THEN 4320
4280 BEEP
4290 INPUT "A value of 2 or more must be entered!  Try again: number of
 in unit = ?",B(27)
4300 GOTO 4270
4310 !
4320 ! Routine to supply values for area & yield if needed
4330 !
4340 IF (B(27)<=1) OR (B(30)=0) THEN 4480
4350 IF (B(23)<>0) AND (B(24)<>0) THEN 4480
4360 INPUT "Cutting unit area (acres) = ?",B(23)
4370 IF B(23)>0 THEN 4410
4380 BEEP
4390 INPUT "You must enter a value greater than 0!  Try again: cutting
 (acres) = ?",B(23)
4400 GOTO 1884
4410 DISP "Yield per acre (";LWC$(A$);") = ";
4420 INPUT B(24)
4430 IF B(24)>0 THEN 4480
4440 BEEP
4450 INPUT "You must enter a value greater than 0!  Try again: yield pe
?",B(24)
4460 GOTO 4430
4470 !
4480 INPUT "Any more variable changes desired ? (YES or NO)",B$
4490 IF B$[1,1]="Y" THEN 3300
4500 IF B$[1,1]<>"N" THEN 4480
4510 B$=""
```

```
4520 IF (B(27)>1) AND (B(30)<>0) THEN 4540
4530 IF B(31)=0 THEN 5040
4540 IF (B(23)<>0) AND (B(24)<>0) THEN 5040
4550 INPUT "Cutting unit area (acres) = ?",B(23)
4560 IF B(23)>0 THEN 4600
4570 BEEP
4580 INPUT "You must enter a value greater than 0!  Try again: cutting
 (acres) = ?",B(23)
4590 GOTO 4560
4600 DISP "Yield per acre (";LWC$(A$);") = ";
4610 INPUT B(24)
4620 IF B(24)>0 THEN 5040
4630 BEEP
4640 INPUT "You must enter a value greater than 0!  Try again: yield p
?",B(24)
4650 GOTO 4620
4660 !
4670 ! Routine to insure that variables # 1,2,3 & 4 have all been give
4680 ! when a new piece of equipment is added
4690 !
4700 FIXED 0
4710 FOR X=1 TO 4
4720 ON N GOTO 4730,4740,4750,4760
4730 ON X GOTO 4770,4890,4920,4990
4740 ON X GOTO 4890,4770,4920,4990
4750 ON X GOTO 4920,4770,4890,4990
4760 ON X GOTO 4990,4770,4890,4920
4770 IF X<=M THEN 4840
4780 DISP "Equipment identifier (30 characters maximum) for piece #";N
4790 INPUT G$(N1)
4800 IF LEN(G$(N1))<=30 THEN 4840
4810 BEEP
4820 INPUT "30 characters maximum!  Try again: enter equipment identif
1)
4830 GOTO 4800
4840 DISP "For piece #";N1;":  Cost of ";G$(N1);" (dollars) = ";
4850 INPUT D(N1,1)
4860 IF D(N1,1)<>0 THEN 5010
4870 GOSUB 3760
4880 GOTO 4840
4890 DISP "For piece #";N1;":  Residual value (percent of equipment co
4900 INPUT D(N1,2)
4910 GOTO 5010
4920 DISP "For piece #";N1;":  Depreciation period (years) = ";
4930 INPUT D(N1,3)
4940 IF D(N1,3)<>0 THEN 5010
4950 BEEP
4960 DISP "The value of 0 may not be entered for this variable!  It mu
ntered."
4970 WAIT 6000
4980 GOTO 4920
4990 DISP "For piece #";N1;":  Repairs and maintenance (percent of equ
reciation) = ";
```

```
000 INPUT D(N1,4)
010 NEXT X
020 RETURN
030 !
040 A=D=M1=0
050 K=1
060 INPUT "Enter identifier for NEW VALUES (25 characters maximum).",D$
070 IF LEN(D$)<=25 THEN 5110
080 BEEP
090 INPUT "25 characters maximum! Try again: enter identifier for NEW VAL
$
100 GOTO 5010
110 INPUT "Enter a new heading for all output (70 characters maximum).".H
120 IF LEN(H$)<=70 THEN 5180
130 BEEP
140 FIXED 0
150 DISP "Sorry, you're";LEN(H$)-70;"characters over the limit of 70!  Tr
 heading = ";
160 INPUT H$
170 GOTO 5120
180 FIXED 2
190 P=1
200 GOTO 930     ! calculate basis of ownership cost
210 PAUSE
220 GOTO 5210
230 !
240 ! ********** KEY 2 (PART 1) **********
250 !
260 S=1
270 !
280 ! ********** KEY 1 (PRINT ANALYSIS) **********
290 !
300 IF P1<>0 THEN 5400
310 IF H$="" THEN 5330
320 PRINT H$,LIN(2)
330 IF (C$="") AND (D$="") THEN 5380
340 IMAGE "ANALYSIS OF VARIABLE CHANGES           BASE VALUES = ",25A,/,
 VALUES  = ",25A,/
350 PRINT USING 5340;C$,D$
360 PRINT TAB(56),"BASE     NEW     PERCENT"
370 GOTO 5470
380 PRINT USING "28A,/,55X,4A,5X,3A,5X,7A";"ANALYSIS OF VARIABLE CHANGES"
 "NEW","PERCENT"
390 GOTO 5470
400 IF H$="" THEN 5420
410 PRINT H$,LIN(2)
420 IF (C$="") AND (D$="") THEN 5460
430 IMAGE "ANALYSIS OF VARIABLE CHANGES           BASE VALUES = ",25A,/,
)",32X,"NEW VALUES  = ",18A,/
440 PRINT USING 5430;C$,D$
450 GOTO 5360
460 PRINT USING "28A,/,8A,31X,4A,10X,3A,6X,7A";"ANALYSIS OF VARIABLE CHAN
ART 1)","BASE","NEW","PERCENT"
```

```
5470 PRINT TAB(55),"VALUES     VALUES    CHANGE",LIN(1)
5480 IF U>1 THEN 5770
5490 E=1
5500 GOSUB 5670
5510 IMAGE "1  COST OF ",30A,"  (DOLLARS)",8D,10D,6D.D
5520 PRINT USING 5510;LWC$(G$(1)),C(1,1),D(1,1),W
5530 E=2
5540 GOSUB 5670
5550 IMAGE "2  RESIDUAL (PERCENT OF EQUIPMENT COST)",21D,10D,6D.D
5560 PRINT USING 5550;C(1,2),D(1,2),W
5570 E=3
5580 GOSUB 5670
5590 IMAGE "3  DEPRECIATION PERIOD (YEARS)",30D,10D,6D.D
5600 PRINT USING 5590;C(1,3),D(1,3),W
5610 E=4
5620 GOSUB 5670
5630 IMAGE "4  REPAIRS AND MAINTENANCE (PERCENT OF DEPRECIATION)",8D,10D
5640 PRINT USING 5630;C(1,4),D(1,4),W
5650 GOTO 6300
5660 !
5670 ! subroutine to compute % change
5680 IF C(1,E)<>0 THEN 5740
5690 IF D(1,E)<>0 THEN 5720
5700 W=0
5710 RETURN
5720 W=100
5730 RETURN
5740 W=100*(D(1,E)-C(1,E))/C(1,E)
5750 RETURN
5760 !
5770 IMAGE "1 #1 COST OF ',30A,"(DOLLARS)",8D,10D,6D.D
5780 PRINT USING 5770;LWC$(G$(1)),C(1,1),D(1,1),100*(D(1,1)-C(1,1))/C(1,
5790 FOR X=2 TO U
5800 IF C(X,1)>0 THEN 5860
5810 IF D(X,1)=0 THEN 5840
5820 W=100
5830 GOTO 5870
5840 W=0
5850 GOTO 5870
5860 W=100*(D(X,1)-C(X,1))/C(X,1)
5870 IMAGE "  #",D," COST OF ",30A,"(DOLLARS)",8D,10D,6D.D
5880 PRINT USING 5870;X,LWC$(G$(X)),C(X,1),D(X,1),W
5890 NEXT X
5900 IMAGE "2 #1 RESIDUAL (PERCENT OF EQUIPMENT COST)",19D,10D,6D.D
5910 PRINT USING 5900;C(1,2),D(1,2),100*(D(1,2)-C(1,2))/C(1,2)
5920 FOR X=2 TO U
5930 IF C(X,2)>0 THEN 5990
5940 IF D(X,2)=0 THEN 5970
5950 W=100
5960 GOTO 6000
5970 W=0
5980 GOTO 6000
5990 W=100*(D(X,2)-C(X,2))/C(X,2)
```

```
000 IMAGE "  #",D," RESIDUAL (PERCENT OF EQUIPMENT COST)",19D,10D,6D.D
010 PRINT USING 6000;X,C(X,2),D(X,2),W
020 NEXT X
030 IMAGE "3 #1 DEPRECIATION PERIOD (YEARS)",28D,10D,6D.D
040 PRINT USING 6030;C(1,3),D(1,3),100*(D(1,3)-C(1,3))/C(1,3)
050 FOR X=2 TO U
060 IF C(X,3)>0 THEN 6120
070 IF D(X,3)=0 THEN 6100
080 W=100
090 GOTO 6130
100 W=0
110 GOTO 6130
120 W=100*(D(X,3)-C(X,3))/C(X,3)
130 IMAGE "  #",D," DEPRECIATION PERIOD (YEARS)",28D,10D,6D.D
140 PRINT USING 6130;X,C(X,3),D(X,3),W
150 NEXT X
160 IMAGE "4 #1 REPAIRS & MAINTENANCE (PERCENT OF DEPRECIATION)",8D,10D,6
170 PRINT USING 6160;C(1,4),D(1,4),100*(D(1,4)-C(1,4))/C(1,4)
180 FOR X=2 TO U
190 IF C(X,4)>0 THEN 6250
200 IF D(X,4)=0 THEN 6230
210 W=100
220 GOTO 6260
230 W=0
240 GOTO 6260
250 W=100*(D(X,4)-C(X,4))/C(X,4)
260 IMAGE "  #",D," REPAIRS & MAINTENANCE (PERCENT OF DEPRECIATION)",8D,1

270 PRINT USING 6260;X,C(X,4),D(X,4),W
280 NEXT X
290 H=1
300 FOR X=5 TO 39
310 IF A(X)<>0 THEN 6370
320 IF B(X)<>0 THEN 6350
330 E(X)=0
340 GOTO 6380
350 E(X)=100
360 GOTO 6380
370 E(X)=100*(B(X)-A(X))/A(X)
380 NEXT X
390 IF H1=1 THEN 6960
400 IMAGE "5  ANNUAL INTEREST RATE (PERCENT)",24D.DD,7D.DD,6D.D
410 PRINT USING 6400;A(5),B(5),E(5)
420 IMAGE "6  TAX,LICENSE,INSURANCE, AND STORAGE (PERCENT)",10D.DD,7D.DD,
430 PRINT USING 6420;A(6),B(6),E(6)
440 IMAGE "7  OPERATING SEASON (DAYS WORKED/YEAR)",22D,10D,6D.D
450 PRINT USING 6440;A(7),B(7),E(7)
460 IMAGE "8  OPERATING TIME PER DAY (HOURS)",25D.D,8D.D,6D.D
470 PRINT USING 6460;A(8),B(8),E(8)
480 IMAGE "9  FUEL CONSUMPTION (GALLONS/HOUR)",23D.DD,7D.DD,6D.D
490 PRINT USING 6480;A(9),B(9),E(9)
500 IMAGE "10 FUEL COST (DOLLARS/GALLON)",28D.DD,7D.DD,6D.D
510 PRINT USING 6500;A(10),B(10),E(10)
```

```
AGE "11 OIL AND LUBE (PERCENT OF FUEL CONSUMPTION)",15D,10D,6D.D
 NT USING 6520;A(11),B(11),E(11)
AGE "12 OIL AND LUBE COST (DOLLARS/GALLON)",20D.DD,7D.DD,6D.D
 NT USING 6540;A(12),B(12),E(12)
AGE "13 LINE COST (DOLLARS)",38D,10D,6D.D
 NT USING 6560;A(13),B(13),E(13)
AGE "14 LINE LIFE (HOURS)",40D,10D,6D.D
INT USING 6580;A(14),B(14),E(14)
AGE "15 RIGGING COST (DOLLARS)",35D,10D,6D.D
INT USING 6600;A(15),B(15),E(15)
AGE "16 RIGGING LIFE (HOURS)",37D,10D,6D.D
INT USING 6620;A(16),B(16),E(16)
AGE "17 TIRE OR TRACK REPLACEMENT COST (DOLLARS)",17D,10D,6D.D
INT USING 6640;A(17),B(17),E(17)
AGE "18 TIRE OR TRACK LIFE (HOURS)",31D,10D,6D.D
INT USING 6660;A(18),B(18),E(18)
AGE "19 TOTAL CREW WAGE (DOLLARS/HOUR)",24D.DD,7D.DD,6D.D
INT USING 6680;A(19),B(19),E(19)
AGE "20 FRINGE BENEFITS (PERCENT OF TOTAL CREW WAGE)",13D,10D,6D.D
INT USING 6700;A(20),B(20),E(20)
AGE "21 TRAVEL TIME PER DAY (HOURS)",27D.DD,7D.DD,6D.D
INT USING 6720;A(21),B(21),E(21)
AGE "22 SUPERVISION AND OVERHEAD (PERCENT OF DIRECT LABOR)",7D,10D,6D.D
INT USING 6740;A(22),B(22),E(22)
 S=1 THEN 6780
 P1=0 THEN 6930
INT LIN(4)
 P1=0 THEN 6810
INT "****** PRESS KEY 3 ('PART 2') TO DISPLAY REMAINDER OF ANALYSIS ****

0
USE
TO 6810

*********** KEY 3 (PRINT ANALYSIS - PART 2) **********

2
 H$="" THEN 6900
INT H$,LIN(2)
AGE "ANALYSIS OF VARIABLE CHANGES            BASE VALUES = ",25A,/,"(PAR
X,"NEW VALUES  = ",25A,/
INT USING 6900;C$,D$
INT TAB(56),"BASE     NEW     PERCENT",LIN(1),TAB(55),"VALUES    VALUES
",LIN(1)
 H=1 THEN 6960
=1
TO 6290
H1=0
 (P1=16) OR (S=2) THEN 6990
INT LIN(2)
0
 (Z7(1)=0) AND (Z7(2)=0) AND (Z8(1)=0) AND (Z8(2)=0) THEN 7050
AGE "23 CUTTING UNIT AREA (ACRES)",32D,10D,6D.D
```

```
7020 PRINT USING 7010;A(23),B(23),E(23)
7030 IMAGE "24 YIELD PER ACRE (",5A,")",32D.DD,7D.DD,6D.D
7040 PRINT USING 7030;A$,A(24),B(24),E(24)
7050 IF Z5=1 THEN 7080      ! known production rate
7060 IMAGE "25 AVG. VOLUME/PIECE AS BUCKED ("5A,")",19D.DD,7D.DD,6D.D
7070 PRINT USING 7060;A$,A(25),B(25),E(25)
7080 IMAGE "26 DEFECT IN PIECES AS YARDED (PERCENT)",18D.DD,7D.DD,6D.
7090 PRINT USING 7080;A(26),B(26),E(26)
7100 IF (Z5=0) OR (A(27)=0) THEN 7120          !A(27)=0 only if known p.
7110 IF (A(27)<=1) AND (B(27)<=1) THEN 7140                    !setting
7120 IMAGE "27 NUMBER OF YARDING ROADS IN UNIT",26D,10D,6D.D
7130 PRINT USING 7120;A(27),B(27),E(27)
7140 IF Z5=1 THEN 7190      ! known production rate
7150 IMAGE "28 AVERAGE NUMBER OF PIECES PER TURN",21D.DD,7D.DD,6D.D
7160 PRINT USING 7150;A(28),B(28),E(28)
7170 IMAGE "29 AVERAGE NUMBER OF TURNS PER HOUR",22D.DD,7D.DD,6D.D
7180 PRINT USING 7170;A(29),B(29),E(29)
7190 IF (Z5=0) OR (A(27)=0) THEN 7210
7200 IF (A(30)=0) AND (B(30)=0) THEN 7230
7210 IMAGE "30 TIME PER ROAD CHANGE (HOURS)",26D.DD,7D.DD,6D.D
7220 PRINT USING 7210;A(30),B(30),E(30)
7230 IMAGE "31 MOVE IN AND MOVE OUT COST (DOLLARS)",22D,10D,6D.D
7240 PRINT USING 7230;A(31),B(31),E(31)
7250 PRINT
7260 PRINT
7270 IMAGE /,/,"OWNERSHIP COST (DOLLARS/HOUR)",28D.DD,7D.DD,6D.D
7280 PRINT USING 7270;A(33),B(33),E(33)
7290 IMAGE "OPERATING COST (DOLLARS/HOUR)",28D.DD,7D.DD,6D.D
7300 PRINT USING 7290;A(34),B(34),E(34)
7310 PRINT SPA(54),"------    ------"
7320 IMAGE "MACHINE RATE (DOLLARS/HOUR)",30D.DD,7D.DD,6D.D
7330 PRINT USING 7320;A(35),B(35),E(35)
7340 IF (A(26)<>0) OR (B(26)<>0) THEN 7610
7350 IMAGE /,"PRODUCTION RATE (",5A,"/HOUR)",29D.DD,7D.DD,6D.D
7360 PRINT USING 7350;A$,A(36),B(36),E(36)
7370 IF (A(30)<>0) AND (A(27)>1) THEN 7390
7380 IF (B(30)=0) OR (B(27)<=1) THEN 7480
7390 IMAGE "ROAD CHANGE COST (DOLLARS/",5A,")",25D.DD,7D.DD,6D.D
7400 IF Z8(1)<>0 THEN 7460
7410 IF Z8(2)=0 THEN 7440
7420 W=100
7430 GOTO 7470
7440 W=0
7450 GOTO 7470
7460 W=(Z8(2)-Z8(1))/Z8(1)*100
7470 PRINT USING 7390;A$,Z8(1),Z8(2),W
7480 IF (A(31)=0) AND (B(31)=0) THEN 7580
7490 IMAGE "MOVE IN AND OUT COST (DOLLARS/",5A,")",21D.DD,7D.DD,6D.D
7500 IF Z7(1)<>0 THEN 7560
7510 IF Z7(2)=0 THEN 7540
7520 W=100
7530 GOTO 7570
7540 W=0
```

```
7550 GOTO 7570
7560 W=(Z7(2)-Z7(1))/Z7(1)*100
7570 PRINT USING 7490;A$,Z7(1),Z7(2),W
7580 IMAGE /,/,"YARDING COST (DOLLARS/",5A,")",29D.DD,7D.DD,6D.D
7590 PRINT USING 7580;A$,A(38),B(38),E(38)
7600 GOTO 7990
7610 IMAGE /,"GROSS PRODUCTION RATE (",5A,"/HOUR)",23D.DD,7D.DD,6D.D
7620 PRINT USING 7610;A$,A(36),B(36),E(36)
7630 IMAGE /,"NET PRODUCTION RATE (",5A,"/HOUR)",25D.DD,7D.DD,6D.D
7640 PRINT USING 7630;A$,A(37),B(37),E(37)
7650 IF (A(30)<>0) AND (A(27)>1) THEN 7670
7660 IF (B(30)=0) OR (B(27)<=1) THEN 7760
7670 IMAGE "GROSS ROAD CHANGE COST (DOLLARS/",5A,")",19D.DD,7D.DD,6D.D
7680 IF Z8(1)<>0 THEN 7740
7690 IF Z8(2)=0 THEN 7720
7700 W=100
7710 GOTO 7750
7720 W=0
7730 GOTO 7750
7740 W=(Z8(2)-Z8(1))/Z8(1)*100
7750 PRINT USING 7670;A$,Z8(1),Z8(2),W
7760 IF (A(31)=0) AND (B(31)=0) THEN 7860
7770 IMAGE "GROSS MOVE IN AND OUT COST (DOLLARS/",5A,")",15D.DD,7D.DD,6
7780 IF Z7(1)<>0 THEN 7840
7790 IF Z7(2)=0 THEN 7820
7800 W1=100
7810 GOTO 7850
7820 W1=0
7830 GOTO 7850
7840 W1=(Z7(2)-Z7(1))/Z7(1)*100
7850 PRINT USING 7770;A$,Z7(1),Z7(2),W1
7860 IF (A(30)<>0) AND (A(27)>1) THEN 7880
7870 IF (B(30)=0) OR (B(27)<=1) THEN 7900
7880 IMAGE /,"NET ROAD CHANGE COST (DOLLARS/",5A,")",21D.DD,7D.DD,6D.D
7890 PRINT USING 7880;A$,Z8(1)/(100-A(26))*100,Z8(2)/(100-A(26))*100,W
7900 IF (A(31)=0) AND (B(31)=0) THEN 7950
7910 IF (A(30)<>0) AND (B(30)<>0) AND (A(27)>1) AND (B(27)>1) THEN 7930
7920 PRINT
7930 IMAGE "NET MOVE IN AND OUT COST (DOLLARS/",5A,")",17D.DD,7D.DD,6D.
7940 PRINT USING 7930;A$,Z7(1)/(100-A(26))*100,Z7(2)/(100-A(26))*100,W1
7950 IMAGE /,/,"GROSS YARDING COST (DOLLARS/",5A,")",23D.DD,7D.DD,6D.D
7960 PRINT USING 7950;A$,A(38),B(38),E(38)
7970 IMAGE /,"NET YARDING COST (DOLLARS/",5A,")",25D.DD,7D.DD,6D.D
7980 PRINT USING 7970;A$,A(39),B(39),E(39)
7990 IF P1=16 THEN 8010
8000 PRINT USING "/,/,/,/"
8010 PAUSE
8020 GOTO 8010
8030 !
8040 ! ********** KEYS 11,12,13,14 & 15 (CHANGE OWNERSHIP COST, OPERATI
8050 !            MACHINE RATE, GROSS VOL/HR & NET VOL/HR) **********
8060 !
8070 N=33                  ! key 11
```

```
0 E$="OWNERSHIP COST"
0 GOTO 8250
0 N=34                  ! key 12
0 E$="OPERATING COST"
0 GOTO 8250
0 N=35                  ! key 13
0 E$="MACHINE RATE"
0 GOTO 8250
0 N=36                  ! key 14
0 IF Z5=0 THEN 8200
0 E$="VOLUME/HR"
0 GOTO 8250
0 E$="GROSS VOLUME/HR"
0 GOTO 8250
0 IF Z5=1 THEN 8160     ! key 15
0 N=37
0 E$="NET VOLUME/HR"
0 FIXED 2
0 PRINTER IS 16
0 PRINT USING "6A,X,15A,X,7A,/,/";"CHANGE",E$,"Routine"
0 PRINTER IS P1
0 DISP E$;":  BASE VALUE =";A(N);"   LAST VALUE =";B(N);"   NEW VALUE = "
0 INPUT B(N)
0 INPUT "Enter identifier for NEW VALUES (25 characters maximum)",F$
0 IF F$="" THEN 8380
0 IF LEN(F$)<=25 THEN 8370
0 BEEP
0 INPUT "25 characters maximum! Try again: enter identifier for NEW VALUE

0 GOTO 8320
0 D$=F$
0 INPUT "Enter a new heading for all output (70 characters maximum).",H$
0 IF LEN(H$)<=70 THEN 8460
0 BEEP
0 FIXED 0
0 DISP "Sorry, you're";LEN(H$)-70;"characters over the limit of 70!  Try
eading = ";
0 INPUT H$
0 FIXED 2
0 GOTO 8390
0 K=1
0 IF N=35 THEN 8490
0 B(35)=B(33)+B(34)      ! machine rate
0 IF (B(30)=0) OR (B(27)<=1) THEN 8520
0 Z8(2)=(B(27)-1)*B(30)*B(35)/B(23)/B(24)      ! setting change cost
0 GOTO 8530
0 Z8(2)=0
0 IF Z5=1 THEN 8570
0 IF N=36 THEN 8580
0 B(36)=B(25)*B(28)*B(29)      ! gross prod. rate if prod. rate unknown
0 IF N=37 THEN 8580
0 B(37)=B(36)*(100-B(26))/100      ! net production rate
0 B(38)=B(35)/B(36)+Z7(2)+Z8(2)      ! gross yarding cost
```

```
39)=B(35)/B(37)+Z7(2)+Z8(2)        ! net yarding cost
 H$="" THEN 8620
INT H$,LIN(2)
 (C$="") AND (D$="") THEN 8660
AGE "ANALYSIS WITH NEW VALUE OF",14X,"BASE VALUES = ",25A,/,20A,20X,"NEW
=  ",25A,/
INT USING 8630;C$,E$,D$
TO 8680
AGE "ANALYSIS WITH NEW VALUE OF",/,20A
INT USING 8660;E$
INT SPA(55);"BASE";SPA(4);"NEW";SPA(4);"PERCENT";LIN(1);SPA(54);"VALUES"
'VALUES";SPA(3);"CHANGE"
R X=33 TO 39
 A(X)<>0 THEN 8760
 B(X)<>0 THEN 8740
)=0
TO 8770
)=100
TO 8770
)=100*(B(X)-A(X))/A(X)
T X
TO 7270

********** KEY 4 (NEW VALUES REPLACED BY BASE VALUES) **********

R X=5 TO 39
)=A(X)
T X
=C$
(2)=Z7(1)
(2)=Z8(1)
T D=C
M
USE
TO 8900

********** KEY 20 (BASE VALUES REPLACED BY NEW VALUES) **********

R X=5 TO 39
)=B(X)
T X
=D$
(1)=Z7(2)
(1)=Z8(2)

outine to remove any deleted pieces of equipment

R X=1 TO U
 (D(X,1)=0) AND (D(X,2)=0) AND (D(X,3)=0) AND (D(X,4)=0) THEN 9080
T X
TO 9230
-1
,1)=D(X+1,1)
```

```
00 D(X,2)=D(X+1,2)
10 D(X,3)=D(X+1,3)
20 D(X,4)=D(X+1,4)
30 G$(X)=G$(X+1)
40 FOR X1=X+1 TO U
50 D(X1,1)=D(X1+1,1)
60 D(X1,2)=D(X1+1,2)
70 D(X1,3)=D(X1+1,3)
80 D(X1,4)=D(X1+1,4)
90 NEXT X1
00 D(X1,1)=D(X1,2)=D(X1,3)=D(X1,4)=0
10 GOTO 9040
20 !
30 MAT C=D
40 M=U
50 PAUSE
60 GOTO 9250
70 !
80 ! ********** KEY 6 (OUTPUT ON PRINTER) **********
90 !
00 P1=0
10 GOTO 9360
20 !
30 ! ********** KEY 5 (OUTPUT ON PLOTTER) **********
40 !
50 P1=16
60 PRINTER IS P1
70 PAUSE
80 GOTO 9370
90 !
00 ! ********** KEY 8 (PLOT ON SCREEN) **********
10 !
20 A7=1
30 DISP "PLOT ON SCREEN"
40 PAUSE
50 GOTO 9440
60 !
70 ! ********** KEY 9 (PLOT ON PLOTTER) **********
80 !
90 A7=2
00 DISP "PLOT ON PLOTTER  -  Plotter must be turned on."
10 PAUSE
20 GOTO 9510
30 !
40 ! ********** KEY 10 (AXES & PLOT) **********
50 !
60 A8=S2=0
70 I=1
80 IF A7=1 THEN 9680      ! plot on screen
90 IF A7=0 THEN 10750     ! plot on plotter
00 !
10 ! plot on plotter routine
20 !
```

```
TTER IS "GRAPHICS"
TTER IS 7,5,"9872A"            ! SET PLOTTER LIMITS TO 6.25 X 6.25 INCHES
TTER 7,5 IS ON
O 9720

lot on screen routine

TTER IS 13,"GRAPHICS"
PHICS
A8=1 THEN 10800

xes & plot

A7<>0 THEN 9780
O 10750
(A(26)<>0) OR (B(26)<>0) THEN 9810
1      ! flag to suppress 'net' or 'gross' label
O 9890
UT "Do you want to plot gross rather that net values? (YES or NO)",B$
B$[1,1]="Y" THEN 9880
B$[1,1]<>"N" THEN 9810
2      ! flag to print 'net' label
37      ! net values will be plotted
39
O 9910
3      ! flag to print 'gross' label
36      ! gross values will be plotted
38
""
S2=1 THEN 10740
ATE 16,96,16,96
 1
2
4

outine to automatically caluclate ranges for horizontal & vertical axes

 A(K1)>=B(K1) THEN 10030
=B(K1)
TO 10040
=A(K1)
 A(K2)>=B(K2) THEN 10070
2=B(K2)
TO 10110
=A(K2)

routine to round off axes values to nearest higher value of 10

 A1 MOD 10<>0 THEN 10140
 A2 MOD 10<>0 THEN 10160
TO 10170
=(A1 DIV 10+1)*10
TO 10120
```

```
60 A2=(A2 DIV 10+1)*10
70 FIXED 0
80 IF B$[1,1]="Y" THEN 10280
90 !
00 DISP "Want to define range of prod. rate & yarding cost other than";A
;" (YES/NO)";
10 INPUT B$
20 FIXED 2
30 IF B$[1,1]="Y" THEN 10260
40 IF B$[1,1]<>"N" THEN 10200
50 GOTO 10280
60 INPUT "Enter: maximum production rate (X-axis), maximum yarding cost
",A1,A2
70 GOTO 10110
80 B$=""
90 A9=A2*1.2
00 SCALE 0,A1,0,A2
10 AXES A1/10,A2/10,0,0
20 LOCATE 0,100,0,100
30 SCALE 0,A1/5*6.25,0,A2/5*6.25
40 CSIZE 3
50 DEG
60 LDIR 0
70 LORG 6
80 FOR X=A1/5 TO A1/5*6 STEP A1/10     ! label horizontal axis
90 MOVE X,A2*.8/5
00 LABEL USING "DD";X-A1/5
10 NEXT X
20 LORG 8
30 FOR X=A2/5 TO A2/5*6 STEP A2/10     ! label vertical axis
40 MOVE A1*.8/5,X
50 LABEL USING "DD";X-A2/5
60 NEXT X
70 LORG 1
80 CSIZE 4
90 MOVE A1/5*1.05,0
00 ON K3 GOTO 10510,10540,10570
10 IMAGE "    PRODUCTION RATE (",5A,"/HOUR)"
20 LABEL USING 10510;A$
30 GOTO 10590
40 IMAGE " NET PRODUCTION RATE (",5A,"/HOUR)"
50 LABEL USING 10540;A$
60 GOTO 10590
70 IMAGE "GROSS PRODUCTION RATE (",5A,"/HOUR)"
80 LABEL USING 10570;A$
90 LDIR 90
00 MOVE A1*.03,A2/5*1
10 ON K3 GOTO 10620,10650,10680
20 IMAGE "    YARDING COST (DOLLARS/",5A,")"
30 LABEL USING 10620;A$
40 GOTO 10800
50 IMAGE " NET YARDING COST (DOLLARS/",5A,")"
60 LABEL USING 10650;A$
```

```
670 GOTO 10800
680 IMAGE "GROSS YARDING COST (DOLLARS/",5A,")"
690 LABEL USING 10680;A$
700 GOTO 10800
710 !
720 ! plot
730 !
740 IF A7<>0 THEN 10770
750 DISP "You must press key 8 or key 9 first."
760 PAUSE
770 IF S2=1 THEN 10800
780 A8=1
790 GOTO 9580
800 LOCATE 0,100,0,100
810 SCALE 0,A1/5*6.25,0,A2/5*6.25
820 LOCATE 16,96,16,96
830 INPUT "Enter: 0 to plot BASE VALUES; 1 to plot NEW VALUES; 2 to plot
oth",A3
840 !
850 ! routine to set line type
860 !
870 A5=A5+2
880 IF A5<>10 THEN 10930
890 A6=A6+2
900 IF A6=10 THEN 11380
910 A5=2
920 GOTO 10870
930 LINE TYPE A5,A6
940 !
950 ! routine to draw curve
960 !
970 A9=A9-A2*.04
980 IF S2=0 THEN 11000
990 GRAPHICS
000 IF A3=1 THEN 11300
010 !
020 ! PLOT BASE VALUES
030 !
040 FOR X=A1 TO .5 STEP -.5
050 A4=Z7(1)+Z8(1)+A(35)/X
060 PLOT X+A1/5,A4+A2/5
070 NEXT X
080 !
090 ! routine to draw lines & label
100 !
110 PENUP
120 MOVE A(K1)+A1/5,A2/5
130 PLOT A(K1)+A1/5,A(K2)+A2/5,-1
140 PLOT A1/5,A(K2)+A2/5,2
150 CSIZE 3
160 MOVE A1*.65,A9
170 DRAW A1*.81,A9
180 MOVE A1*.85,A9
```

```
1190 LORG 2
1200 LDIR 0
1210 LINE TYPE 1
1220 LABEL C$
1230 IF (A(K1)<>B(K1)) OR (A(K2)<>B(K2)) OR (A3<>2) THEN 11280
1240 A9=A9-A2*.04
1250 MOVE A1*.81,A9
1260 LABEL "& ";D$
1270 GOTO 11670
1280 IF A3=0 THEN 11670
1290 !
1300 ! PLOT NEW VALUES
1310 !
1320 ! routine to set line type
1330 !
1340 A5=A5+2
1350 IF A5<>10 THEN 11420
1360 A6=A6+2
1370 IF A6<>10 THEN 5690
1380 DISP "No more plots allowed!"
1390 PAUSE
1400 A5=2
1410 GOTO 11340
1420 IF A3=1 THEN 11480
1430 LINE TYPE A5,A6
1440 !
1450 ! routine to draw curve
1460 !
1470 A9=A9-A2*.04
1480 FOR X=A1 TO .5 STEP -.5
1490 A4=Z7(2)+Z8(2)+B(35)/X
1500 PLOT X+A1/5,A4+A2/5
1510 NEXT X
1520 !
1530 ! routine to draw lines & label
1540 !
1550 PENUP
1560 MOVE B(K1)+A1/5,A2/5
1570 PLOT B(K1)+A1/5,B(K2)+A2/5,-1
1580 PLOT A1/5,B(K2)+A2/5,2
1590 CSIZE 3
1600 MOVE A1*.65,A9
1610 DRAW A1*.81,A9
1620 MOVE A1*.85,A9
1630 LORG 2
1640 LDIR 0
1650 LINE TYPE 1
1660 LABEL D$
1670 MOVE A1*1.2,A2*1.2
1680 K=0
1690 PAUSE
1700 GOTO 11690
1710 !
```

```
11720 ! ********** KEY 24 (HARD COPY OF PLOT) **********
11730 !
11740 IF I=1 THEN 11780
11750 BEEP
11760 DISP "No hard copy can be made!  You must plot something firs
11770 PAUSE
11780 IF A7=1 THEN 11820
11790 BEEP
11800 DISP "No hard copy can be made!  Your plot was made on the pl
11810 PAUSE
11820 DUMP GRAPHICS
11830 GCLEAR
11840 PAUSE
11850 GOTO 11840
11860 !
11870 ! ********** KEY 26 (PLOT ONLY) **********
11880 !
11890 IF I=1 THEN 11940
11900 BEEP
11910 DISP "You must make a plot with axes first!  Access key 10 be
."
11920 PAUSE
11930 GOTO 11920
11940 IF K=1 THEN 11990
11950 BEEP
11960 DISP "You must make one or more changes through key 0,11,12,1
rst!"
11970 PAUSE
11980 GOTO 11970
11990 S2=1
12000 GOTO 9910
12010 END
12020 PLOTTER IS "GRAPHICS"
12030 PLOTTER IS 7,5,"9872A"
12040 PLOTTER 7,5 IS ON
12050 X=0
12060 FOR X1=1 TO 7
12070 FOR X2=1 TO 3
12080 LINE TYPE X1+3,2+2*X2
12090 X=X+1
12100 MOVE 0,2*X
12110 DRAW 60,2*X
12120 NEXT X2
12130 NEXT X1
12140 PAUSE
```

```
KEY 0
  -Clear
  CONT3260
  -Execute
KEY 1
  -Clear
  CONT5280
  -Execute
KEY 2
  -Clear
  CONT5240
  -Execute
KEY 3
  -Clear
  CONT6850
  -Execute
KEY 4
  -Clear
  CONT8800
  -Execute
KEY 5
  -Clear
  CONT9330
  -Execute
KEY 6
  -Clear
  CONT9290
  -Execute
KEY 7
  -Clear line
  REWIND ":T15"
  -Execute
KEY 8
  -Clear
  CONT9400
  -Execute
KEY 9
  -Clear
  CONT9470
  -Execute
KEY 10
  -Clear
  CONT9540
  -Execute
KEY 11
  -Clear
  CONT8070
  -Execute
KEY 12
  -Clear
  CONT8100
  -Execute
KEY 13
  -Clear
  CONT8130
  -Execute
KEY 14
  -Clear
  CONT8160
  -Execute
KEY 15
  -Clear
  CONT8220
  -Execute
KEY 20
  -Clear
  CONT8930
  -Execute
KEY 24
  -Clear
  CONT11720
  -Execute
KEY 26
  -Clear
  CONT11870
  -Execute
```

Description of Variables – 9845 Program

A$	Volume unit description
A()	Base variable values
A	Total average annual investment
A1	Maximum value of production rate for plot
A2	Maximum value of yarding cost for plot
A3	Flag to indicate if plot is for base values, new va both
A4	Flag to indicate if yarding cost is to be plotted
A5	Line type identification number for plot
A6	Line type length for plot
A7	Flag to indicate if plot is on the screen or printe
A8	Flag to indicate if axes and plot or plot only is t
A9	Vertical distance to the plot and to the label of l and identifier
B$	"YES" or "NO" response to visual prompts
B()	New variable values
B	Dummy to read DATA
C$	Identifier for base values
C()	Base variable values
D$	Identifier for new values
D()	New variable values
D	Total equipment depreciation
E$	Variable type description
E()	Percent change between base value and new value
E	Counter
F$	Temporary identifier for new values
F	Flag for determining if test for variable value equ zero is required
G$()	Equipment identifier
H$	Heading
H	Flag to determine if part 1 of Print analysis routi been accessed
H1	Flag to route program if part 2 of Print analysis r accessed prior to part 1
I	Flag to determine if key 10 has been pressed before
J	Temporary storage for New Value
K	Flag to determine if key 26 can be accessed or not
K1	Value to allow plot of gross or net production rate
K2	Value to allow plot of gross or net yarding cost
K3	Flag to select plot labels
L	Line cost/hour
M	Number of base pieces of equipment
M1	Total repairs and maintenance cost
N	Number of the variable that is to be changed
N1	Number of the equipment piece
P	Flag to route to calculations for production rate a if VARIABLE CHANGES routine is accessed
P1	Printer mode (CRT or internal thermal printer)
Q	Direct labor cost plus supervision and overhead cos
R	Rigging cost/hour

S	Flag to indicate which part of Print analysis ro been accessed
S2	Flag to indicate if key 26 (Plot only) is access
T	Tire or track cost/hour
U	Current number of base or new pieces of equipmen is greater)
W	Percent change from base value to new value
Wl	Percent change from base value to new value
X	Counter
Xl	Counter
Z5	Flag to indicate if production rate is known (Z5 unknown (Z5=0)
Z7()	Move in and move out cost (dollars/gross unit vo
Z8()	Total setting change cost (dollars/gross unit vo

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